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HISTORY OF THE 1ST MISSILE DIVISION

VANDENBERG AIR FORCE BASE, CALIFORNIA

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STRATEGIC AIR COMMAND

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HISTORY OF THE
1ST MISSILE DIVISION

by

Carl Berger

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VANDENBERG AIR FORCE BASE
CALIFORNIA

5-1461-14

FOREWORD

The 1st Missile Division is currently playing a major role in building the aerospace power of the Strategic Air Command. This brief history, prepared by the headquarters historian, tells the story of the Division and what it has accomplished in the recent past to develop America's operational missile strength. The vital missile programs being conducted by the Division at Vandenberg Air Force Base, and its growing mission in support of the Air Force satellite programs, constitute in a very real sense the beginning of an aerospace capability for the nation and the Strategic Air Command.

DAVID WADE
Major General, USAF
Commander

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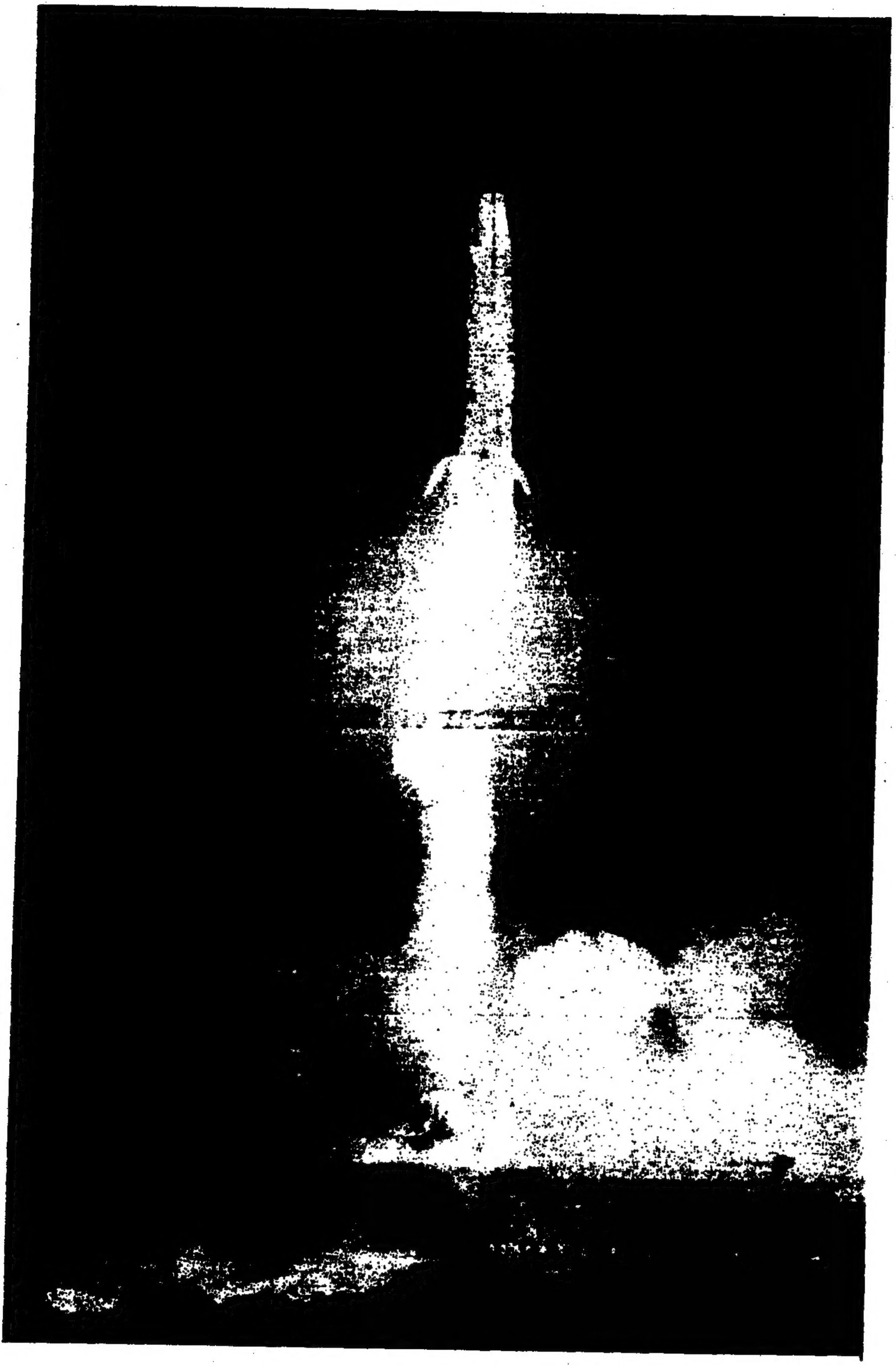
AUTHOR'S NOTE

This study is based on materials contained in the semi-annual historical narratives of the 1st Missile Division, supplemented by histories and reports of other Air Force missile and aircraft organizations. Published works—books, magazines and newspapers and similar sources——also have been drawn upon. The reader will find the cited footnote references and a selected bibliography at the end of the narrative. In addition, there has been included a chronology and special appendix prepared by T/Sgt Bruce Pollica of the Historical Division. The manuscript was typed by Miss Lorraine Olivares.

Carl Berger
Command Historian

Vandenberg Air Force Base
April 11, 1960



The first Atlas launch from Vandenberg Air Force Base, September 9, 1959.

CHAPTER I

Burton Mesa and the 1st Air Division in World War II

Although the 1st Missile Division is a relatively new organization, it has origins which go back to World War II. One of its beginnings involves the command's ancestral unit, the 1st Air Division, which played an important role in the assault against Germany's industrial and military power. A second involves Vandenberg Air Force Base, located on Burton Mesa, a dry plateau on the Pacific coast 168 miles northwest of Los Angeles. Vandenberg originally began its military career in 1941 as an Army tank and infantry training camp. A third element from the war involves Germany's famous ballistic missile, the V-2, one of the great technological developments of recent military history.

The Mesa

In May 1941, when Army surveyors arrived on Burton Mesa, few Americans could have foreseen the dramatic events which now are being enacted on the sandy soil. Named after a one-time Tennessee trapper, Lewis F. Burton, who crossed a near-empty continent to settle in southern California in 1831, the mesa was the home of wild animals, deer herds and bob cats, living among the mesquite and scrub oak. As time went on ranchers stocked the area with domestic animals which, by the year 1881, consisted of 40 horses, 500 cattle and 10,000 sheep.[1]

In the months before the Japanese attack on Pearl Harbor in December 1941 propelled the United States into World War II, the Army found Burton Mesa to be an ideal site to train tank divisions, infantry and other troops. Rising 217 feet from the sea, the land was surrounded by the Casmalia hills to the north, the Purisima hills to the east and the Santa Ynez mountains to the south. From the viewpoint of safety for tank and other firing exercises, the numerous nearby canyons offered a perfect setting. The terrain also had the advantage of isolation, the nearest communities of consequence being Lompoc, 10 miles to the south, and Santa Maria, 20 miles to the north.

The government purchased the land---86,000 acres in 122 tracts---and construction of a cantonment began in September 1941. The name selected for the new Army post was

Camp Cooke, in honor of a Civil War Union general.* Beginning in 1942 the 5th, 6th and 11th Armored Divisions, the 97th Infantry Regiment, and the 2nd Philippine Infantry Regiment, as well as special troops such as combat engineers and medical personnel, received training at Camp Cooke.[2]

Activation of the 1st Air Division

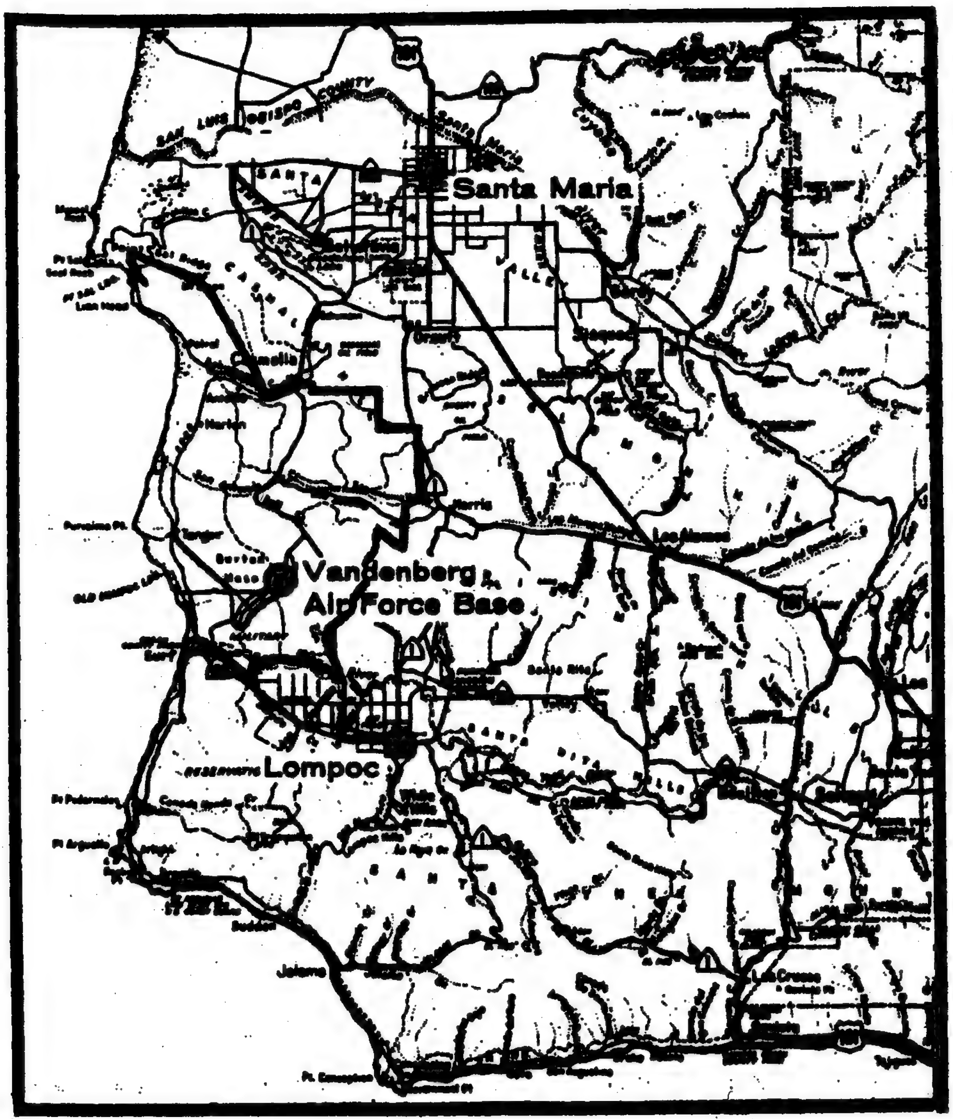
While the dust of Burton Mesa was being raised by the lumbering tanks and marching feet of armored and infantry units, thousands of miles away the Army Air Force's 1st Air Division** was activated on September 13, 1943, at Brampton Grange, England. Shortly thereafter the Division, composed of the 1st, 40th and 41st Combat Bombardment Wings, struck at Frankfurt, Germany, on October 4, 1943, and at the German submarine and warship works at Bremen on October 8.[3]

In one of its most important raids against the Schweinfurt ball-bearing works on October 14, 1943, the Division was badly mauled by German fighter planes. Out of

---

*Philip St. George Cooke, a native of Virginia. General Cooke's family split over the war and his son and more famous son-in-law, Jeb Stuart, served as officers in the Confederate Army.

**Originally designated the 1st Bombardment Division, the command was renamed the 1st Air Division on January 1, 1945.


SAN LUIS OBISPO COUNTY
Santa Maria
Vandenberg
Air Force Base
Lompoc

a total of 291 B-17s it and the 3rd Bombardment Division sent against that heavily-defended target, 60 planes failed to return. One wing of the 1st Air Division, the 40th, lost 29 planes. Despite the heavy loss the raid was considered one of the most important of 16 the Division made against Schweinfurt---inflicting the most damage and slowing German production.[4]

In the immediate pre-Normandy invasion period during the spring of 1944, the Division devoted its entire resources to attack on industry and airdromes supporting the German Luftwaffe. Following the D-day landings it gave support to Allied ground operations, bombing enemy troop concentrations near St. Lo and facilitating the Allied breakout and race across France to the German frontier.

The German V-2 Program

Even while the Division was successfully penetrating the enemy's air space, down below German scientists led by Major General Walter Dornberger and Werhner von Braun were working feverishly against time to perfect the V-2 ballistic missile. The key dates in the development of this famous weapon were: (a) October 3, 1942, when the V-2 flew successfully for the first time, travelling 118 miles; (b) August 17, 1943, when more than 500 British heavy bombers attacked Peenemunde, Germany's Cape Canaveral, causing important delays in the V-2 program;[5] and (c) September 6, 1944, when the first operational V-2s were fired against Paris (going unreported) and September 8 when two more V-2s struck London, marking the beginning of the German ballistic missile assault against that city.[6]

For the Germans the V-2 had come too late. Nevertheless, they managed in the eight remaining months of the war to fire about 1,500 V-2s against London and southern England, more than 2,100 against Antwerp[*] and others against the liberated city of Brussels. Only the Allied seizure of the enemy-held coastal areas and the drive into the heart of Germany ended the fearful bombardment.

Although the V-2 carried only a ton of explosive and proved to be highly inaccurate, the missile was one of the outstanding weapon developments of the war. Liquid-fueled and with a radio inertial guidance system, V-2 stood 46 feet high (only 19 feet shorter than the Air Force's current Thor intermediate range ballistic missile), weighed 46,000 pounds and had a range at the end of its development period of up to 225 miles. It achieved a speed of Mach 5 coming in on its target----the fastest machine man ever devised.

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[*] Dornberger's figures. The British reported 1,115 of the rockets actually fell in their country or within sight of the shore. Altogether these missiles killed 2,724 persons and seriously injured 6,467, with the greatest number of casualties occurring in London.

With the collapse of Germany a race developed between the Soviet forces and the U.S. Army to seize as much of the V-2 equipment as they could find. The Russians gathered in a great deal of equipment and facilities in the part of Germany they overran, including a battered Peenemunde. Thousands of German rocketmen, consistly largely of the V-2 production and engineering staffs, fell into Russian hands. The Soviets also collected many of the German blueprints including, it would seem, a plan for a two-stage rocket that could span the Atlantic and strike the coast of America.[7]

The United States was helped by the fact that Dornberger, Von Braun and other Peenemunde scientists decided to surrender themselves to the American Army (they fled to Bavaria in the face of the Russian advance). The Army also seized the underground V-2 factory in the Harz mountains and cleaned it out in the summer of 1945, shipping tons ov V-2 components to the United States. These were to be used in a scientific and military launch program to be initiated at the White Sands Proving Grounds, New Mexico, in the post-war period.

War's Aftermath

However, with the war over America's interest in military matters all but collapsed. The 1st Air Division was inactivated in England on October 31, 1945. Camp Cooke on the California coast soon was closed down and became a ghost facility, reclaimed by the persistent morning fog. At White Sands the Army, with the help of the German and later American scientists, began a leisurely firing program with the V-2. Little urgency was felt since most Americans seemed to think a new war would not come again for at least 20 or 30 years.

CHAPTER II

Rearmament and the 1st Missile Division

If the 1st Missile Division's ancestry goes back to World War II, the immediate post-war period 1945-1950 also was a time for the command's incubation. This was the period when the United States unilaterally disarmed while the Soviet Union, continuing to maintain the largest military forces in Europe, entered into a research and development program to develop the atomic bomb and to extend the range of the German V-2 missile.*

The United States did not begin to take significant steps to rearm until after the Russians turned the Cold War hot with the Communist invasion of South Korea on June 25, 1950. One small phase in this rearmament effort was reactivation of Camp Cooke to again train armored and infantry divisions to fight in the new war in Korea.

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*The Soviets exploded their first atomic bomb in August 1949. By the late 1950s they had developed four primary types of large liquid rocket engines: the Russian version of the German V-2; an improved V-2 called the R-10; a scaled up V-2 called the R-14; and an improved version of the latter called the R-14A. This super V-2 generated 264,000 pounds of thrust at sea level.---See Donald J. Ritchie, "Soviet Rockets Exploit German Technology, "*Missiles and Rockets*, December 7, 1959, pp. 17-19.

America's rebuckling on of its shield was largely along conventional lines---planes, tanks, artillery, naval and infantry weapons. However, while the Korean War was being fought with weapons only slightly advanced from those used in World War II, U. S. scientists detonated history's first hydrogen bomb device at Eniwetok atoll on November 1, 1952.

Within a short period of time such important progress was made in nuclear weapons technology that it appeared likely the United States (and the Soviet Union) could eventually produce small, high yield warheads that could fit into a missile. In the summer of 1953 the Air Force was informed by a panel of scientific experts* that high yield, low weight warheads could be developed by the 1959-1960 period.

This prediction completely changed the Air Force's original attitude towards long range ballistic missiles. Several years earlier the Air Force had initiated developmental studies on an intercontinental ballistic missile (ICBM). But in 1947 the project was dropped, partly for economic reasons and partly because the U. S. had superiority in a weapon system (manned bombers) that could deliver payloads accurately on target, whereas missiles fired over great distances were at the time not considered technologically feasible. However, by 1951 enough knowledge had been accumulated on the subject for the Air Force to award a contract to Convair for continued study and design of an ICBM; but only very conservative developmental policies were followed.

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*The panel included Dr. Edward Teller and the late Professor John von Neumann.

The destructive power of a hydrogen warhead entirely changed this picture. Pinpoint accuracy no longer was a major consideration. The thermonuclear breakthrough of 1952-1953 provided the impetus leading directly to the Air Force's current ballistic missile program, and to the creation and activation of the 1st Missile Division.

1954: The Air Force Begins the Atlas Program

The prediction concerning possible future nuclear warhead development was followed by creation of an Air Force Strategic Missiles Evaluation Committee, composed of leading scientists and engineers. This committee reviewed the Air Force's various missile programs and in February 1954 recommended that, in view of the thermonuclear breakthrough, the United States "redirect, expand and accelerate" the development of the intercontinental ballistic missile.[9]

With a growing sense of urgency the Air Force took a series of steps which was to place responsibility for developing the ICBM on a single central manager. This was accomplished in August 1954 with the creation of the Air Force Ballistic Missile Division (AFBMD)* of the Air Research and Development Command (ARDC). Subsequently, the Air Force also negotiated a contract with a private corporation, Ramo-Wooldridge, to handle the technical direction and systems engineering for the ICBM program.[10]

By the end of 1954 the research and development (R&D) organization was functioning and, nine months later, the Atlas program was assigned the nation's highest priority.

Selecting a Training and Operational Base

Besides its developmental mission (expanded in 1955 to include 1,500 mile intermediate range missiles), AFBMD was given the added mission of achieving the initial operational capability (IOC) with the oncoming weapon systems.** One of the early steps required by the IOC mission was the selection of a training site, which also could serve as the location of the nation's first operational Atlas ICBM squadron.

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*Originally designated the Western Development Division.

** In cooperation with the Strategic Air Command, the eventual operational command.

In January 1956 Major General Bernard Schriever,[*] the commander of AFBMD, established a committee to select a site. The committee included representatives from Headquarters USAF, SAC, ARDC, and the Air Materiel Command and began its work with a review of 200 possible locations, areas already under the control of the three services. The list was eventually reduced to 15 sites in California, Nevada and Oregon, which were visited and studied, and then reduced to four possible locations. One of these was Camp Cooke, which had been inactivated by the Army once again towards the end of the Korean War.[11]

It soon became evident to the committee that Cooke was the best possible location for several of the same reasons that had led the Army to select the area initially. Isolation and the rugged surrounding areas provided excellent safety features. In addition, the mesa had the advantage of fronting on the vast Pacific Ocean into which the Air Force could launch its missiles with little or no overfly dangers.*

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[*] Now a lieutenant general and head of ARDC.

Still another reason for Cooke's final selection was its proximity to manufacturers involved in the missile program, and to AFBMD's Inglewood, California, headquarters. On September 1, 1956, the Secretary of the Air Force, the late Donald Quarles, accepted General Schriever's recommendation of Camp Cooke.[12] Several weeks later Secretary of Defense Charles Wilson directed that the portion of Cooke lying north of the Lompoc branch of the Southern Pacific railroad---64,000 acres---be transferred to the Air Force for use in the ICBM/IRBM program. The Navy was later given control of the southern portion of the old camp area, which it redesignated the Naval Missile Facility, Point Arguello. The Army retained use of the U.S. Disciplinary Barracks near Lompoc (now a Federal Correctional Institution).

In January 1957 the Air Force obtained a use permit for its new facility (formally transferred by the Army effective June 21, 1957), and the following month the first airman arrived at the cantonment. Temporarily renamed Cooke Air Force Base, the facility was formally rededicated on October 4, 1958, in memory of the late General Hoyt S. Vandenberg, the second Chief of Staff of the Air Force (1948-1953), who also had served during World War II as Commander of the Ninth Air Force in Europe.

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*There was one unavoidable safety problem involving the presence of the Southern Pacific railroad, whose track ran along the coast through Burton Mesa between Los Angeles and San Francisco. To protect passing trains during missile launchings, special "hold" procedures were worked out in cooperation with the railroad in 1958-1959.

Activation of the 1st Missile Division

Selection of the base to be the ICBM/IRBM training site and location of the first operational Atlas squadron, was followed by several organizational improvizations leading to activation of the 1st Missile Division at Los Angeles on April 15, 1957. One of these involved establishment of an office of "Special Assistant to the Commander (General Schriever) for IOC" in February, with Colonel William A. Sheppard assigned primary duty.

In March, after Colonel Sheppard took up his new duties, AFBMD decided that an Air Division should be activated to serve as the command headquarters "for administrative and operational control of the Zone of Interior strategic force (ICBM) and the Zone of Interior strategic missile training site (ICBM-IRBM)."[13] The 1st Air Division, then in inactive

Vandenberg Air Force Base was named in honor of the late General Hoyt S. Vandenberg, second Chief of Staff of the Air Force (1948-1953).

status, was selected as the headquarters. However, effective March 18, 1957, it was renamed the 1st Missile Division.[14]

To head the new Division General Schriever chose Colonel Sheppard, who was assigned the following mission:

1. Achieve a capability to train IRBM and ICBM crews and units.
2. Train assigned ICBM units to meet programmed requirements.
3. Train assigned IRBM units and prepare these units for overseas deployment as programmed.
4. Attain and maintain a combat capability with assigned ICBM units. 15

Concurrent with the activation of the Division at Los Angeles, a supporting organization, the 392d Base Headquarters and Air Base Squadron, was reconstituted and renamed as Headquarters, 392d Air Base Group. Its duty station at Vandenberg* became effective April 15, 1957.

It was not until several months later that the 1st Missile Division began its move to its permanent home on Burton Mesa. The new commander, Colonel Sheppard, was well aware that he was embarking on a unique voyage. He wrote to one of his newly-assigned officers in May 1957: "We are in the formative stage on missile methodology. . .No pattern has been established."[16]

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*At the time the base still was referred to as Cooke. However, hereafter in this narrative the Vandenberg designation will be used.

The 1st Missile Division was to become the pattern-maker.

CHAPTER III

Building a Missile Base

The cantonment, lying silent and deserted, was a depressing sight when the Division arrived on the scene. The old yellow mobilization-type World War II Army barracks, weather-beaten and forlorn, were sunk in weeds and overgrown brush. The few roads that existed, mostly gravel and dirt trails, were broken in places or so covered with growth that it was difficult to distinguish them from the fields. The water treatment plant was in a state of disrepair; communication facilities were neglected; and living quarters scarcely existed. Into this bleak scene came the first officers and men of the 392d Air Base Group, the 704th Strategic Missile Wing,* and the 1st Missile Division to begin the enormous task of building a missile base.

Formal ground-breaking ceremonies to mark the start of construction were held on May 9, 1957. In a brief dedicatory address to a gathering of press, radio and civilian dignitaries from nearby communities, Major General Osmond J.

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*The Wing, an operational arm of the Division, was activated on July 1, 1957. In the spring of 1959, following a reorganization, its functions and personnel were absorbed by the Division. It was inactivated July 1, 1959.

Ritland of the Air Force Ballistic Missile Division spoke of the vast increase of activity that was to follow. Substantial numbers of contractor personnel and technicians, as well as growing numbers of military personnel, were scheduled to arrive on base to begin extensive rehabilitation and modernization of barracks, mess halls, chapels, and other support facilities. Concerning the missiles themselves, General Ritland said new construction of facilities totalling millions of dollars also was to be started. A modernized runway and airfield to support the missile program was planned. Dollarwise, he predicted the total basic construction program would be "roughly in the vicinity of $100,000,000."[17]

In this prediction the General turned out to be highly conservative. Subsequent world events gave such impetus and importance to the missile program that, by the end of 1959, more than $200,000,000[*] had been expended at Vandenberg, with the end not in sight.

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[*] Basic construction and installation program costs. The figure does not include monthly outlays for food, utilities and transportation, or costs of equipment, training and administration. Taken together with future projects programmed or planned, they bring Vandenberg's total cost (1957 1960) to an estimated $700,000,000.

The Critical Personnel Problem

In the summer of 1957 one of the earliest problems facing the Division was the lack of trained personnel, a condition resulting partly from the fact there were few qualified missile personnel in the Air Force not already assigned to the Ballistic Missile Division's critical research and development program. One solution that offered itself was to provide new personnel on-the-job training at AFBMD's headquarters or the Air Force Missile Test Center, Patrick Air Force Base and at missile contractor facilities. The concept of on-the-job training was adopted and became a key element in the missile training program for the operational squadrons.

Another factor in the personnel shortage involved stringent manpower controls placed upon the military services in the summer of 1957. At Vandenberg the shortage was such that an integrated organization was formed, pooling all personnel assigned to the Division, Wing and the Combat Support Group in order to perform necessary jobs. By late 1957, however, the situation eased somewhat, and each organization

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*The 392d Air Base Group was later reorganized and redesignated the 392d Combat Support Group (January 1, 1959).

resumed their separate identity.

The Problem of Housing

Related to the shortage of people was the problem of getting Air Force officers and men interested in the missile program. At Vandenberg, in view of the primitive housing situation, it was clear unless there was a rapid improvement in living conditions, few Air Force personnel, especially those with families, would be motivated to stay in missiles.

With no on-base housing for family men, the few rentals in the two nearby communities of Lompoc (population 6,500 in 1957) and Santa Maria (population 12,000) were soon filled. As the demand for housing rose steadily, rents also started to rise. Many airmen, unable to complete for the limited private housing, began to spread out through the area, some being forced to commute daily to the base from as far as Santa Barbara, 65 miles away.*

Realizing that on-base housing was essential, the Air Force quickly obtained congressional approval for construction of new three-and four-bedroom Capehart family quarters. The Capehart program became one of the early priority construction projects which began in 1957. The first increment,

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*A housing boom soon developed in the county. See Appendix II to this study, "Impact of Vandenberg Air Force Base on the Surrounding Communities."

880 units, was followed by approval of two more housing increments to bring total on-base housing (when completed by 1961) to 1805 units.

For married men not eligible for Capehart quarters (airmen in the lower grades), trailer court sites were set aside on base and the first ones were soon filled.* For the unmarried airmen mobilization-type barracks, which once housed 74 men, were converted into modern dormitories with separate two-and three-man rooms. Bachelor officer quarters also were converted into spacious apartment units.

This important housing effort, to retain and motivate Air Force personnel to follow the critical career of missilemen, became one of the foundations of Vandenberg's future.

Technical Construction Begins

On May 1, 1957 an Army Corps of Engineers contractor began building the first technical facility, the Mod II Atlas guidance station.[19] Other construction contracts were let in the weeks and months that followed——to build the first Thor and Atlas launch emplacements, the blockhouses and technical support facilities, liquid oxygen (LOX) plants and missile assembly buildings (MABs).

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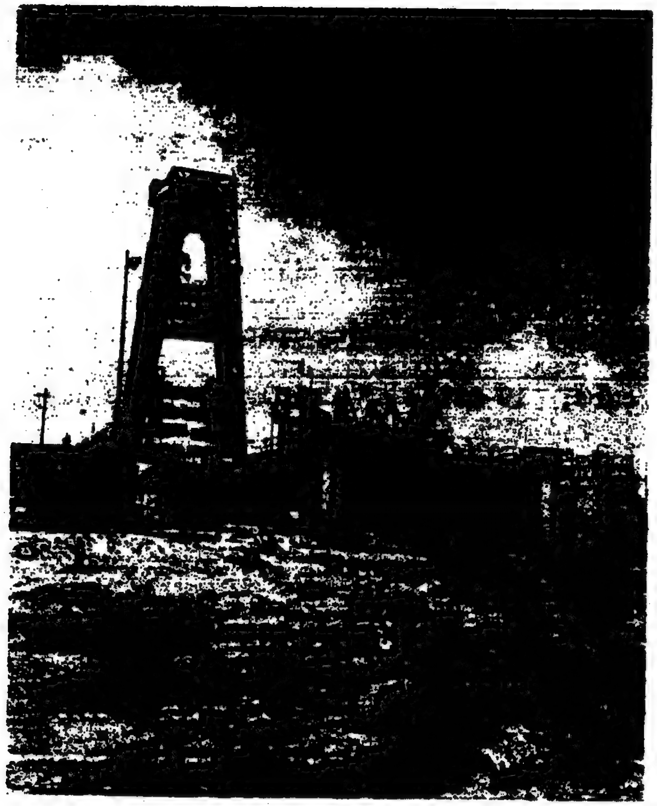
*To total over 400 when completed.

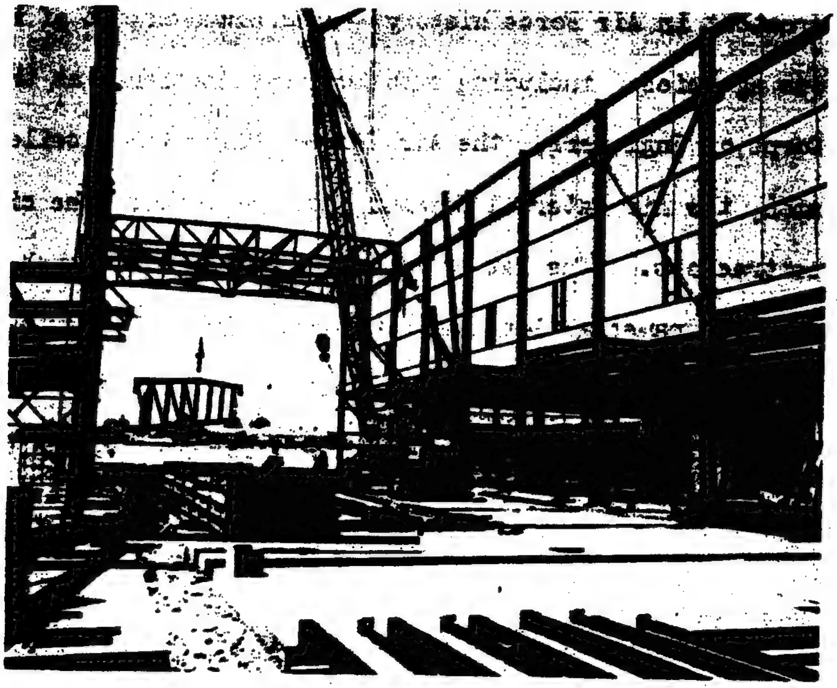
On the base proper a number of necessary support projects, which began in 1957, saw rehabilitation of office buildings; renewal of the road network; and restoration of the water plant and communications facilities. Hundreds and later thousands of construction workers, carpenters, plumbers, plasterers, electricians, and technicians swarmed over the mesa and the base was filled with the noise and dust of huge construction machines and trucks carrying equipment and building materials to work sites. The Lompoc-Casmalia road, running through the heart of the base, became weighted down by a huge rise in traffic.

In time the new architecture of the missile age began to rise out of the sandy soil of Burton Mesa: the gantry towers to hold the first Atlas missiles; the radar ears and telemetry antenna, cocked toward the heavens; the blockhouses and missile buildings. Later the mesa itself was attacked by huge earth-moving machines, to gouge out giant silos for the oncoming Titan ICBM.

The statistics on the tremendous construction and renovating job on Vandenberg began to pile up impressively.



New forms of the missile age break the skyline at Vandenberg Air Force Base. Above an Atlas launch facility under construction; below a missile assembly building.



By late 1959 they told of nearly 2,000 structures newly built or renovated; 20 miles of new roads built and 30 miles of roads rebuilt; 20 more miles of shale-top access roads constructed; paved parking space laid down for more than 2,000 cars; 10 miles of drainage ditches dug; 30 miles of water pipeline laid; a completely new airfield built, including an 8,000-foot runway; and 13 missile launching stands completed.[20]

The quantities of materials used were equally imposing: the airfield runway and the 13 missile launchers alone consumed more than one and one-quarter million bags of cement; while the nails used to renovate one group of 100 structures amounted to a full load of 40 pickup trucks.

The Vandenberg construction story became one of the greatest in Air Force history---a combined effort of numerous agencies including such key organizations as the Army Corps of Engineers, the Air Force Ballistic Missile Division, the Air Materiel Command and, of course, the civilian contractors. The latter were represented by such famous aviation names as Douglas, Convair, Martin, Lockheed and Boeing; and General Electric, Kellogg Communications, American Machine and Foundry, Aerojet General Corp., Avco Corp. , Philco, Burroughs Corp., Bethlehem Steel, Thiokal Chemical, RCA, Rocketdyne.

A cross-section of American industry came together to build at Vandenberg Air Force Base.

Effect of Soviet Missiles and Sputniks on the Air Force Program

In the summer of 1957, while the 1st Missile Division was still in the early stages of its organization, a startling claim was made by the Soviet government. It reported on August 27 that it had, a few days earlier, launched "a super long-distance intercontinental multi-stage ballistic missile" which had flown "at a very high, unprecedented altitude." The results showed, reported Moscow, "that solving the problem of designing intercontinental ballistic missiles will make it possible to reach remote areas without resorting to a strategic air force...."[21]

The Soviet announcement of August 27 had little immediate effect on the U. S. missile program. Several months later, on October 4 and on November 3, 1957, the Russians dramatically launched history's first two earth satellites---the second vehicle weighing a reported 1,120 pounds and carrying a live dog.

These feats had a tremendous impact on world public opinion. In Washington the U. S. government now reacted and the reaction was soon felt across the continent at Vandenberg by the 1st Missile Division.

CHAPTER IV

Transfer to the Strategic Air Command

The launching of the Soviet sputniks, whirling around the earth at 18,000 miles per hour, had obvious military implications. They resulted in an almost immediate acceleration of the Air Force ballistic missile program, with one important aspect of this acceleration being the transfer of the 1st Missile Division and its subordinate units to the Strategic Air Command. The transfer was announced on November 29, 1957 by General Thomas D. White, the Air Force Chief of Staff. General White directed the head of the Strategic Air Command, General Thomas S. Power, to take over from AFBMD the responsibility for attaining the initial operational capability.[22]

To succeed Colonel Sheppard as commander of the 1st Missile Division, General Power selected his Chief of Staff, Major General David Wade. In a letter to Wade in December, the SAC commander described the transfer of the IOC responsibility as "an opportunity for a combined Air Force effort for the early incorporation of ballistic missiles into the operational inventory."

Since the Division was to be the first SAC ballistic missile organization, General Power provided some guidelines to Wade pending publication of an official mission statement. General Wade was to:

1. Exercise command jurisdiction over all units, facilities and personnel assigned to or attached to the 1st Missile Division.

2. Attain and maintain a combat capability with assigned ICBM units.

3. Train assigned ICBM units to meet programmed requirements.

4. Train assigned IRBM units and prepare those units for overseas deployment as required.[23]

The transfer of the Division to SAC became effective on January 1, 1958. The next day General Wade arrived at Vandenberg to assume command and there now followed a quickening of operational planning and actions. New funds were made available and newly-assigned Air Force personnel began arriving at a faster pace. Initial tasks to which General Wade turned his attention included manning and organization of the operational missile squadrons to be activated, and training plans. Meanwhile, at higher headquarters,

Major General David Wade, Commander of the 1st Missile Division; former Chief of Staff of the Strategic Air Command.

deployment planning was being speeded up.

Activation of the Missile Squadrons

The first of the several key missile training units, the 392d Missile Training Squadron (IRBM-Thor), had been activated at the base on September 15, 1957, several months before SAC entered the scene. When on December 31 Headquarters USAF revised activation and operational dates for IRBM and ICBM squadrons, in the early months of 1958 the pace of activations quickened. Among the organizations established under the 1st Missile Division were:

1. The 864th Technical Training Squadron (IRBM-Jupiter), originally a strategic missile squadron activated January 15, 1958, with duty station at Redstone Arsenal, Huntsville, Alabama. It was followed by activation of two more Jupiter units, the 865th and 866th. The Jupiter missile, an Army-developed IRBM, was assigned to the Air Force by the Secretary of Defense on February 28, 1958.*

2. The 704th Instrumentation Squadron, activated on February 1, 1958. This unique Air Force organization was

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*The 1st Missile Division monitored the Jupiter training program at Huntsville. In the spring of 1959 the U. S. signed an agreement with a North Atlantic Treaty Organization (NATO) ally, Italy, to deploy Jupiter to that country.

made responsible for installing, maintaining and operating the missile flight safety system at Vandenberg.*

3. The 576th Strategic Missile Squadron (ICBM-Atlas), activated April 1, 1958---to become the first Air Force squadron to achieve an operational capability with the nation's first ICBM.

4. The 51st Aviation Depot Squadron, activated July 25, 1958, and assigned responsibility for receiving, inspecting and maintaining re-entry vehicle systems and associated warheads at Vandenberg, and conducting integrated training for specialists assigned to the operational squadrons.[25]

(A list of missile organizations assigned to the 1st Missile Division as of December 31, 1959, will be found on the next page).

The Integrated Weapon System Training Program

The 1958 speed-up of an already fast-moving missile

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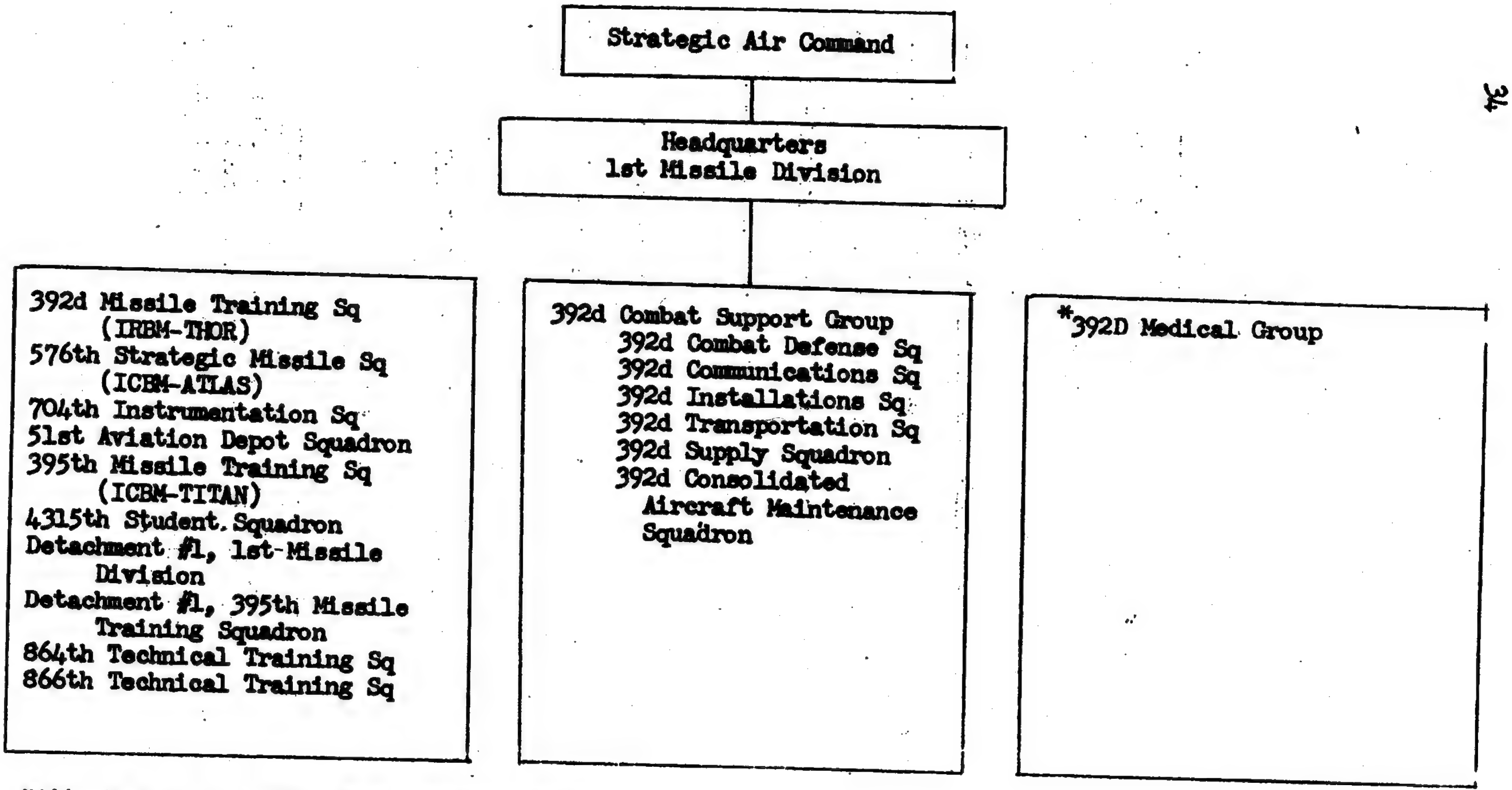
*The 704th operated the system during more than 24 missile and satellite launchings from Vandenberg. By June 1960, however, certain missile flight safety responsibilities were to be turned over to the Pacific Missile Range, a national range operated by the Navy with the 1st Missile Division being a major "user".


Strategic Air Command
Headquarters
1st Missile Division
392d Missile Training Sq
(IRBM-THOR)
576th Strategic Missile Sq
(ICBM-ATLAS)
704th Instrumentation Sq
51st Aviation Depot Squadron
395th Missile Training Sq
(ICBM-TITAN)
4315th Student. Squadron
Detachment #1, 1st-Missile Division
Detachment #1, 395th Missile Training Squadron
864th Technical Training Sq
866th Technical Training Sq
392d Combat Support Group
392d Combat Defense Sq
392d Communications Sq
392d Installations Sq
392d Transportation Sq
392d Supply Squadron
392d Consolidated Aircraft Maintenance Squadron
*392D Medical Group

*Attached to the 392d Combat Support Group for administrative and logistical support.

Organization as of
31 December 1959

developmental program created an unusual situation for the Division. The program had been proceeding along the lines of AFBMD's famous policy of "concurrent actions," i.e., conducting research, development, test, production, manpower training and base construction almost simultaneously. Under the original plan the first Thor operational squadron (Thor was the most advanced of the U. S. ballistic missiles under development) was not scheduled to begin training until late 1958. Facilities construction was hinged on that date.

But with the operational dates revised it became apparent to the Division and other participating Air Force agencies that training would have to begin without benefit of adequate equipment.

The Royal Air Force Comes to Vandenberg

The missile training program, as it developed during 1958, involved two phases: individual on-the-job training by students at various contractor factories, the Air Force Missile Test Center or Ballistic Missile Division headquarters; and Integrated Weapon System Training (IWST) at Vandenberg Air Force Base.

That the earliest and some of the most important "crew" training should begin, not with U. S. missilemen but with officers and men of the Royal Air Force (RAF) was the result of an unusual Anglo-American agreement signed in the spring of 1958.* This agreement called for the United States to train and equip four RAF strategic missile squadrons to be deployed in the United Kingdom.[26]

In May 1958, within weeks after final agreement was reached, the first group of British airmen began arriving in the United States to start individual training at the Douglas Aircraft Company's facility at Tucson, Arizona; the A.C. Spark Plug Division (General Motors) plant at Milwaukee, Wisconsin; and the Rocketdyne (North American Aviation) facility at Van Nuys, California.

On July 8, 1958 the first RAF officer, Flying Officer Cyril D. Quinton, arrived at Vandenberg to establish a liaison office for the Division and the British trainees, who began appearing on base in early August. Then, on August 20, 1958 forty-seven British and ten USAF trainees entered the Division's first Integrated Weapon System Training class.

These students faced certain handicaps since no operational training facilities were available at the time. The best the Division and AFBMD's contractors could do, as classroom lectures began, was to allow students to observe "over-the-shoulder" as installation and checkout of the Thor emplacements continued.

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*The agreement grew out of initial discussion between President Eisenhower and Prime Minister Harold MacMillan at the Bermuda Conference in March 1957.

The lack of launching facilities---one of the consequences of the accelerated program---was unfortunate and troubling to both the Division and the Royal Air Force.[27] Nevertheless, a certain amount of training was accomplished and, by the close of 1958, a total of 245 British missilemen from the 77th and 97th Strategic Missile Squadrons (RAF), completed this "interim" IWST and returned to their home bases. Not until March 1959, following final turnover to the Division of the first Vandenberg Thor emplacements, was a proper setting provided for operational training. (See Chapter V)

The First Vandenberg Launch

Shortly after he assumed command General Wade expressed the desire that the first Thor IRBM launch from Vandenberg be an Air Force, rather than a contractor launch. A first firing was a requirement placed on the contractor by the Air Force to demonstrate that the weapon system was in order and functioning properly. Now, on the basis of General Wade's request, arrangements were made for intensive launch crew training of six personnel from the 392d Missile Training Squadron.[28]

Through the summer and fall of 1958, while these men were studying missile launch techniques and procedures, construction was speeded on the Thor emplacements. When the contractor at last reported he could have at least one pad in a near-operational configuration towards the end of the year, the Division initiated final planning for the launch, to be conducted first in November and then in December when installation difficulties cropped up.

As the December launch date approached a number of dress rehearsals were held for the special crew, who included: Capt. Bennie Castillo, 35, launch control officer; Capt. John C. Bon Tempo, 35, systems monitor; Senior M/Sgt Charles E. Gifford, 49, launch monitor control officer; M/Sgt Max L. Meyer, 27, guidance alignment technician; M/Sgt William L. Hodges, 45, missile technician; and M/Sgt Michael J. Aueri, 44, missile technician.

All personnel involved in the exercise recognized the importance of a first successful launch. Thus it was with much relief and satisfaction when, on December 16, 1958, the

Times Telephone Numbers
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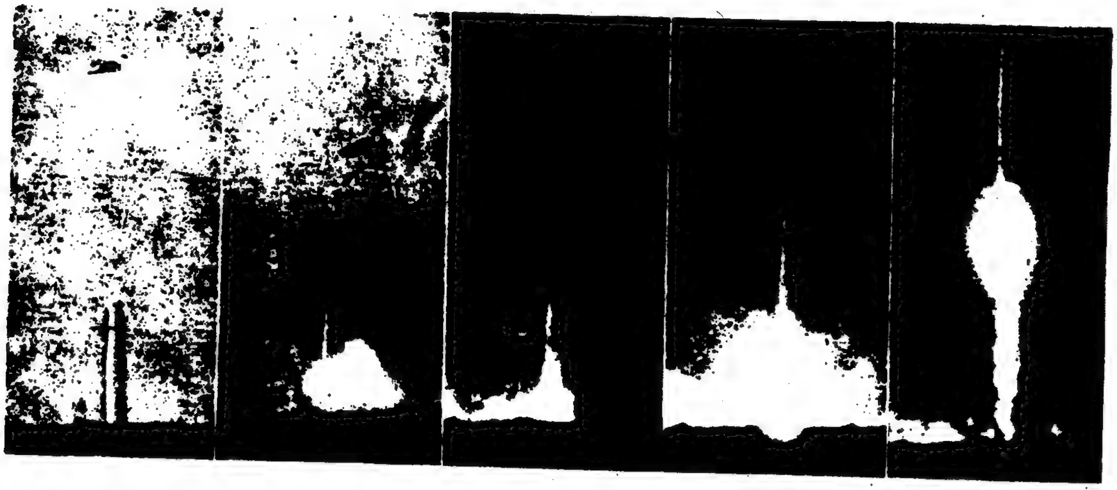
Los Angeles Times
LIBERTY UNDER THE LAW — TRUE INDUSTRIAL FREEDOM
9 A.M. FINAL

VOL. LXXVIII — IN FOUR PARTS — WEDNESDAY MORNING, DECEMBER 17, 1958 — 88 PAGES — DAILY 10c

LAUNCH THOR MISSILE FROM NEW CAL. BASE

Big Thor Missile Blasts Off to Open West Coast Base



WEST COAST DEBUT—This long range sequence shows the Thor ballistic missile, the first ever fired by a combat crew blasting off on its West Coast debut to inaugurate the new Vandenberg Air Force Base

PACIFIC MISSILE SOARS

First Fired By AF Crew

By [illegible]

VANDENBERG AIR FORCE BASE (AP)—An Air Force crew lobbed a combat-type Thor missile 1,500 miles westward over the Pacific missile range yesterday.

[illegible]

A-6 Los Angeles Herald & Express 5C Wednesday, Dec. 17, 1958

Thors Fly 1500 Miles Over Sea

U.S. Shows Missile Punch Over Atlantic and Pacific

By [illegible]

VANDENBERG AIR FORCE BASE, Dec. 17—In an awesome display of two-ocean punch, America has rocketed two Thor missiles 1500 miles over the Atlantic and Pacific oceans, landing five miles from the target point.

[illegible]

launch crew assumed control of the weapon system for the final 15-minute countdown and successfully fired Thor missile 151 some 1,500 miles over the Pacific Ocean. Lift-off was at 1544:45 Pacific Standard Time. General Wade, in a follow-up report to General Power on the operation, listed a number of historic "firsts" resulting from the launch. It constituted, he reported:

1. The first ballistic missile fired from Vandenberg westward into the Pacific Missile Range.

2. The first known operation where new equipment, a new missile, new personnel and a new organization were integrated into a successful operation.

3. The first completely automatic launch of a fully operational ballistic missile using normal IOC launching procedures.

4. The first ballistic missile to be launched by a Strategic Air Command operational crew.[29]

With this important success behind them, the officers and men of the 1st Missile Division, the 392d Missile Training Squadron and other organizations on base turned their attention to the new year, planning for a rapid rise in operational launch activities.

CHAPTER V

1959: Thor and Atlas Become Operational

The achievement of a first Thor launch from Vandenberg in December 1958 preceded highly important developments at the base. During the twelve months that followed progress was made in the Integrated Weapon System Training program for operational RAF squadrons, whose crews fired ten Thor missiles during the year. But perhaps more important for the nation, the 1st Missile Division achieved an operational status with the Atlas intercontinental ballistic missile following the first successful launch of that missile by a SAC crew on September 9, 1959.

The RAF Thor Training Program

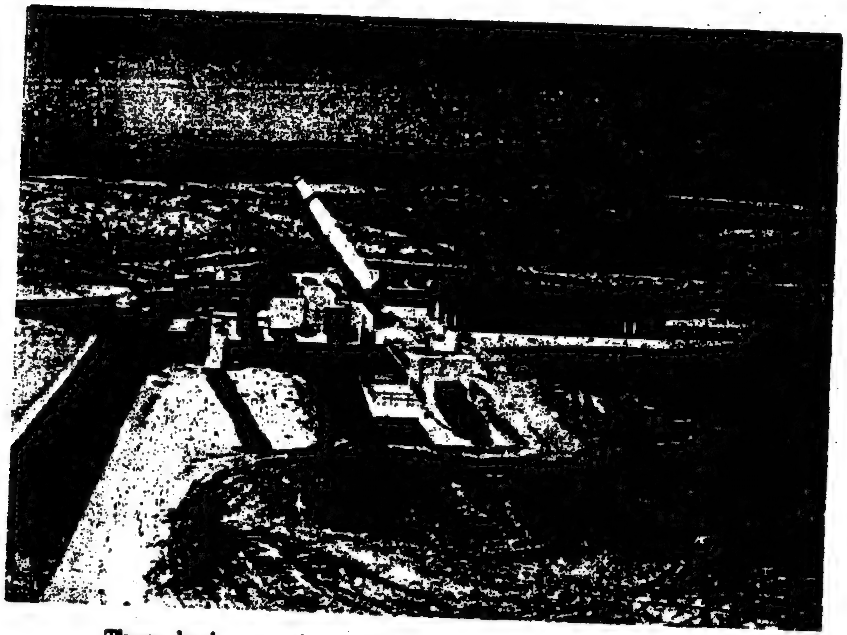
The first Royal Air Force trainees, as noted in the previous chapter, had been forced into an "interim" IWST program at Vandenberg due to lack of launch facilities. After much additional effort was expended by the contractors and the Air Force, a class of 118 RAF students entered training on March 2, 1959 using operational equipment for the first time.[30] The trainees were from the 98th Strategic Missile Squadron (RAF).

From this first formal class five launch crews were formed and later the best one was chosen to attempt the first British launch of the Thor. This select crew consisted of: Squadron Leader Peter G. Coulson, 37, launch control officer; Master Pilot Maurice H. Sloan, 35, launch control console operator; and Chief Technican Roy M. Carpentier, 35, missile maintenance technican. The launch was to be considered a graduating exercise which ended eight weeks of integrated training.

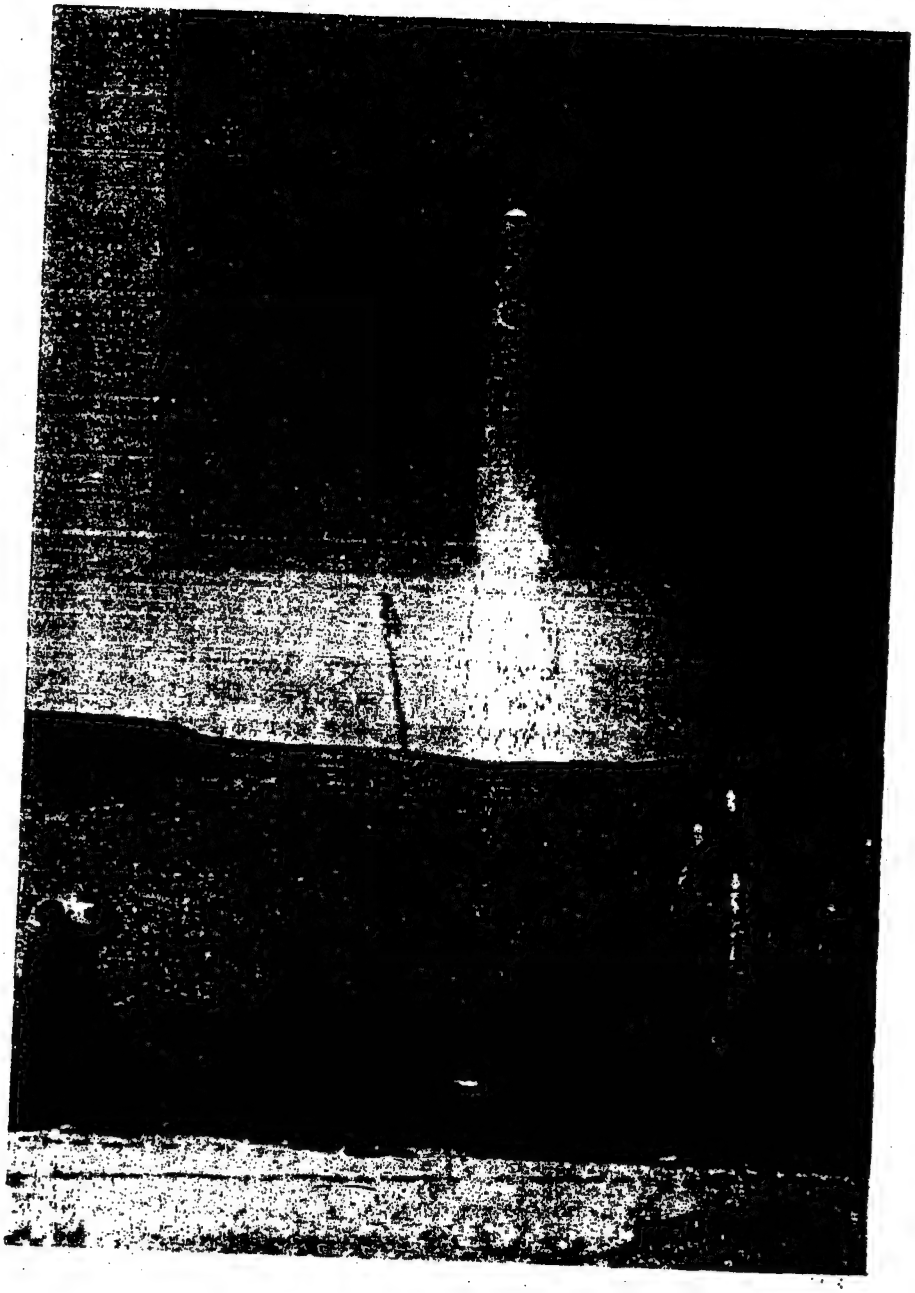
In April, as the graduation day approached, command techniques developed by the 1st Missile Division in coordination with SAC and the British Bomber Command, were set in motion. The launch was scheduled for April 14, 1959. Unfortunately, the day of the planned exercise technical difficulties with the weapon system forced a postponement. The following day unfavorable weather conditions caused a second 24-hour delay.

There was disappointment and some uneasiness over these delays, not only among the RAF and USAF personnel but also among a group of British newspapermen who were visiting the base to cover the operation for the English press. However, on the third attempt on April 16 all phases of the launch

Squadron Leader Peter G. Coulson, launch control officer, who fired the first RAF Thor missile from Vandenberg Air Force Base.



Thor being raised into a firing position.



LIONS ROAR, the historic first launch of a Thor missile by a crew of the Royal Air Force at Vandenberg, April 16, 1959.

operation proceeded smoothly; the three-man crew successfully fired the first RAF Thor into the Pacific Missile Range. As the American and British airmen congratulated each other, even the formerly critical newsmen spoke approvingly.[31]

In the months that followed the launch much was learned about long-range ballistic missiles by the Division and the Royal Air Force. As training problems developed the Division and the 392d Missile Training Squadron improvized solutions or adopted new approaches. Some repetitive training exercises, found to be unnecessary, were discarded;* others, new ones, were added. From lessons learned from the Thor training program, the Division and its subordinate commands proceeded to "write the book" about the needs and demands of the highly-sensitive high-performing ballistic missiles.

A Missile Goes Awry

A familiar problem, which only time and persistent effort were to resolve, involved the missile itself, a vehicle barely out of the research and development stage. The result of the compressed developmental/operational situation, missile failures were thoroughly aired for the American people through publicity given to mishaps at Cape Canaveral.

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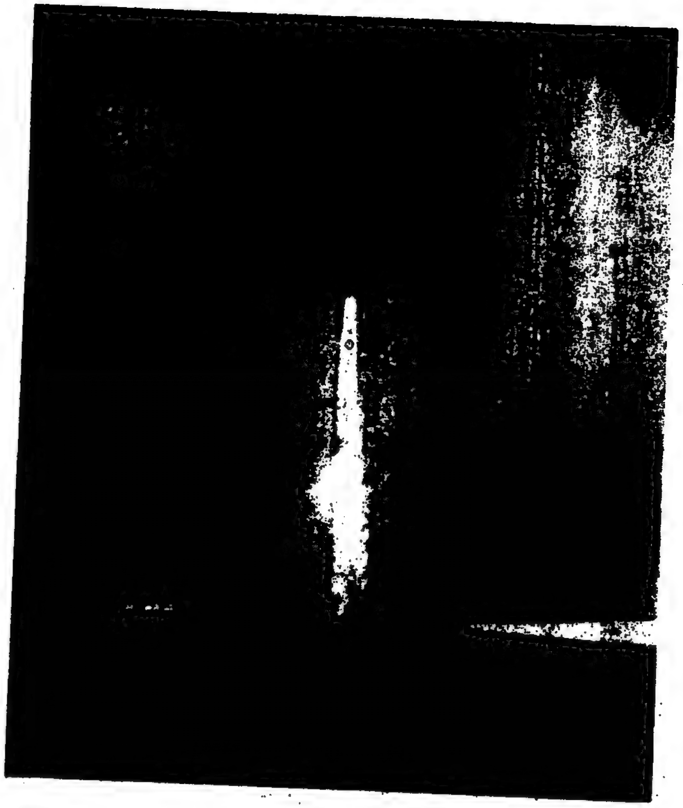
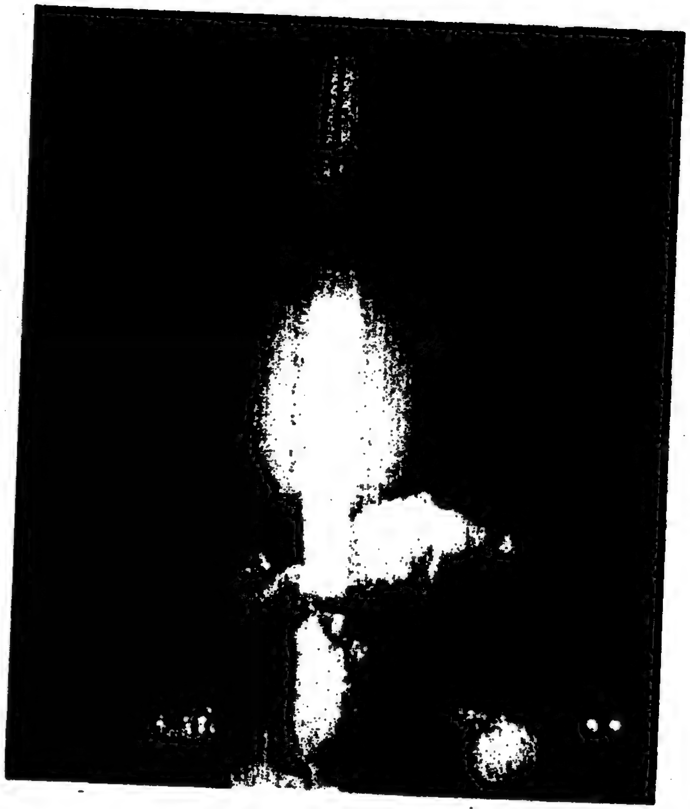
*Such as the number of dry count downs a launch crew should perform. They were reduced in number.



The sixth RAF launch from Vandenberg and the first combat training launch exercise, October 6, 1959. Highly successful.



The ninth RAF launch and the first night firing from the base, December 1, 1959. Successful.

> Also of great importance is the tremendous increase of deterrent power which is now being supplied around the clock by the Vandenberg-trained Royal Air Force crews who are manning the operational Thor squadrons in the United Kingdom. 35

The completion of the Thor IWST program was not, however, the end of the British presence at Vandenberg. RAF missile crews were scheduled to return periodically to conduct proficiency firing exercises.

The Atlas Program at Vandenberg

While the success achieved during 1959 in the Thor program added strength to the free world, from the viewpoint of the nation and the Strategic Air Command a far more significant achievement related to America's first intercontinental ballistic missile, the Atlas.

The initial ICBM squadron, the 576th, had been activated at the base on April 1, 1958 and, in time, was assigned a dual mission: operations and training. Soon after its activation, the squadron sent its personnel to the contractor plants and other facilities to begin the individual phase of their training. This phase was to last almost a year, while at Vandenberg construction men worked under great pressure to complete the first operational launch emplacements.

Troubles at Cape Canaveral

Meanwhile, at Cape Canaveral important problems also developed in the missile test program. During the spring of 1959 several attempts to launch the Series-D operational Atlas ended in well-publicized failures.[36]

The public and private concern that was expressed led General Schriever, while appearing before a congressional committee in July 1959, to attempt to reassure members that there was no cause for alarm. Such setbacks, he said, were normal and to be expected in a developmental program; he predicted no more than a 60-day delay before achieving an operational status at Vandenberg.[37]

General Schriever's faith was borne out the same day he appeared before the committee, when a Series-D missile was successfully fired from Cape Canaveral, ending the string of failures.

The "Noise of a Hundred Freight Trains"

At Vandenberg in the summer of 1959 AFBMD and the missile contractors were working feverishly to complete the first operational launch facilities. On August 22 the contractors, helped by personnel from the Atlas squadron who had been integrated with the civilian crews for training

Atlas prior to static firing acceptance test at Vandenberg, August 22, 1959.

Senior M/Sgt Vernon I. Tannheimer, 576th Strategic Missile Squadron, at one of the Atlas consoles.

> Then the shout came from the observers, just 9,200 feet from the launch pad. "There's fire in the tail."
>
> ...(It) quickly exploded into a large orange ball. Slowly the powerful engines, capable of developing 360,000 pounds of thrust, raised the 250,000 pound missile upward. Gradually it began to gain speed, and as it cleared the gray haze it appeared as a huge silver bullet pushed by a ball of flame.
>
> Higher and higher it went, straight up into the heavens as gasps of admiration and amazement escaped from the onlookers.
>
> As it cleared the horizon the noise, like that of a hundred freight trains, increased in intensity. There were sharp cracks in the thunderous sound, and then the noise washed over the observation site and all that was left was the silver bullet and the ball of flame. 39

The missile plunged towards its selected target 4,400 miles away near Wake Island. The Commander of SAC, at the scene with General Wade, declared the successful operation to be "a tremendous milestone" in the history of the Air Force ---a team effort by American science and industry, the Air Research and Development Command and the Strategic Air Command.

General Wade told a gathering of newsmen he was "more than satisfied" with the missile and the performance of the personnel of the 576th.[40] The launch control officer was Captain Gerald J. Winchell, 30; the guidance control officer, Captain Dewey M. Garwood Jr., 35; and site commander, Major Ernest E. Bankey Jr., 38, an Air Force ace who shot down 11 enemy planes in Europe in World War II.*

The 576th Goes Operational

In the weeks that followed the launch, a certain amount of "tidying up" was to be done, and the men of the 576th eagerly pitched in. Morale in the squadron, whose members were "in missiles because they want to be in missiles," was high. Convinced they were making important contributions to the prevention of another World War, they also were proud in their belief that they could perform effectively with the Atlas if war came.[41]

In October, after completing their "tidying up," the 576th entered an alert status and, on November 3, General Wade formally announced to the world: "The Atlas squadron at Vandenberg is now integrated into the Strategic Air Command's emergency war plan and is ready to launch on 15 minutes notice." The alert was to continue from that time on.

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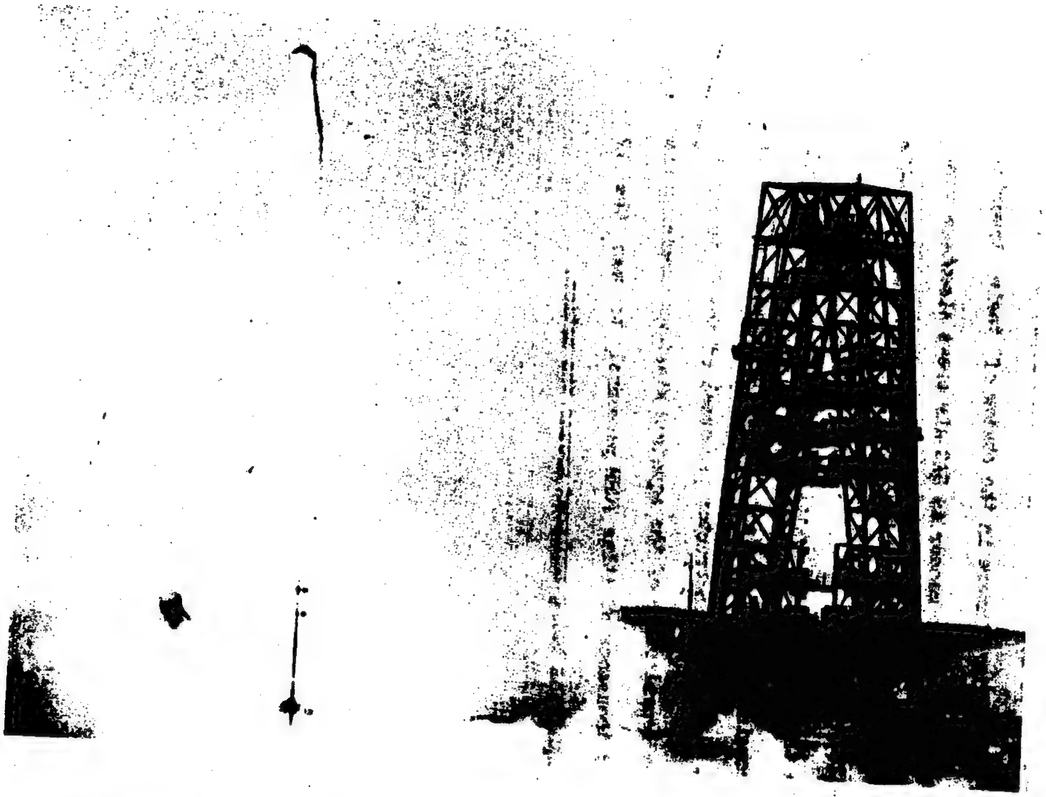
*An Atlas launch crew developed into a basic unit of 13 men: A launch control officer, missile system analyst, power distribution system technician, missile electrician, three missile maintenance technicians, a missile engine mechanic, ground support equipment specialist, propulsion system technician, guidance system analyst and hydraulics technician. The number of guidance control personnel varies with the type of system used.



The second Atlas launch from Vandenberg Air Force Base, January 26, 1960.

The Christmas of 1959 for the first time found SAC missilemen eating holiday dinners in the shadow of their towering missiles, in the same manner as SAC air crews elsewhere were eating their dinners within sprinting distance of their B-47s and B-52s.

In the months that followed, while the operational crews remained on alert (and launched a second Atlas on January 26, 1960), instructor personnel of the 576th initiated the second phase of the squadron mission: training the first of thousands of Atlas ICBM personnel to man the 12 other squadrons being emplaced around the nation.

CHAPTER VI

The Air Force Satellite Programs and Titan and Minuteman

In the early months of 1959 the attention of the world was drawn to Vandenberg by the famed Discoverer program, conducted by the Air Force Ballistic Missile Division, which produced history's first polar orbiting vehicles. The 1st Missile Division early became associated with the Discoverer, providing through special agreements with AFBMD the satellite launching sites and logistical/operational support of the base.

The program's objectives were detailed for a congressional committee in February 1959 by a Department of Defense official, Roy W. Johnson, who explained that:

> The launch vehicle utilizes a modified Thor as the first stage and a new rocket...(called Agena) as the second stage. This combination can launch satellites weighing approximately 1,300 pounds, including the weight of the second-stage vehicle, which will orbit as an integral part of the satellite. The initial launching primarily will be to test the vehicle itself, especially its propulsion and guidance. Later the satellite will contain biomedical experiments to seek data on environmental conditions and recovery of those experiments will be undertaken. 43

The first launch in the series took place on February

28, 1959, when a Thor-boosted satellite lifted off a Vandenberg pad and soared into the southern skies on a heading of approximately 182 degrees.[46] For some time after the launch only sporadic and random signals were received from the vehicle, leading to speculation that the satellite had not gone into orbit. However, by March 4 forty-one random tracking reports were received, allowing refinement of orbit information which fixed the satellite's apogee at 605 miles above the earth, its perigee 99 miles and the orbital period 95 minutes.

Discoverer I was followed by nine more launch efforts during 1959 and into the early months of 1960. Six of the nine satellites went into polar orbits (See charts on the following pages). During these operations the imagination of the world was particularly stirred by the Air Force plan to recover the space capsules from the orbiting vehicles.

This plan involved a triggering device to eject the reentry capsule somewhere over the Pacific, following the satellite's seventeenth pass around the earth. A parachute was to lower the capsule through the atmosphere where an "air snatch" attempt was to be made by Hawaii-based C-199 aircraft.

Although no capsules were recovered during the first ten

RE-CAP OF DISCOVERER PERFORMANCE
SATELLITES I THROUGH

DISCOVERER	I	II	III	IV
Date of Launch	28 Feb 59	13 Apr 59	3 Jun 59	25 Jun 59
Apogee	605	220	n/a	n/a
Perigee	99	142	n/a	n/a
Countdown and Liftoff	x	x	x	x
Separation of Second Stage	x	x	x	x
Second Stage Ignition and Command Computing	x	x	x	x
Orbit Velocity Attainment	x	x	v	v
Stabilization and Command on Orbit	Not Attempted	x	n/a	n/a
Capsule Separation	Not Attempted	x	n/a	n/a
Recovery	Not Attempted	x_1	n/a	n/a
Communications, Tracking and Data Acquisition	v	x	x_3	x_3

(x) Objective Achieved (v) Objective Not Achieved

1. Re-entered. Parachute deployment accomplished over Spitsbergen. No air-snatch recovery was possible.
2. No radio signals were received from recovery beacon. No visual sightings.
3. Communications, tracking and data acquisition were solid thru launch, coast and injection phase.
4. Failure of an inverter which provided power for the IR scanner and the separation sequence prevented full stabilization on orbit and proper separation of the capsule.

RE-CAP OF DISCOVERER PERFORMANCES
SAT ITES V THROUGH X

DISCOVERER	V	VI	VII	VIII	IX	X
Date of Launch	13 Aug 59	19 Aug 59	7 Nov 59	20 Nov 59	4 Feb 60	19 Feb 60
Apogee	450	537	550	1,000	n/a	n/a
Perigee	136	138	104	120	n/a	n/a
Countdown and Liftoff	x	x	x	x	x	x
Separation of Second Stage	x	x	x	x	x	n/a
Second Stage Ignition and Command Computing	x	x	x	x	x	n/a
Orbital Velocity Attainment	x	x	x	x	v	n/a
Stabilisation and Command on Orbit	x	x	v[4]	x	n/a	n/a
Capsule Separation	x	x	v[4]	x	n/a	n/a
Recovery	v[2]	v[2]	v[4]	v[5]	n/a	n/a
Communications, Tracking and Data Acquisition	x	x	x	x	v[6]	v[7]

(x) Objective Achieved   (v) Objective Not Achieved

5. Positive indications of retro-rocket firing; capsule re-entry; and beacon operation prior to parachute deployment.
6. Initial velocity insufficient to achieve orbit. Acquisition and tracking on launch satisfactory.
7. Vehicle was destroyed 56 seconds after lift off by the range safety officer. A flight control electronics system malfunction was believed the source of difficulty.

launchings (at least two re-entry capsules successfully ejected, one over the Spitzbergen area near the Arctic Circle and another over the Pacific),* the Air Force in this program had successfully devised a stabilization device which kept the satellite's longitudinal axis parallel to the earth, an important advance.

Midas and Samos

As the Discoverer program was proceeding (more launchings were planned), the 1st Missile Division also was called upon to provide support to two new satellite programs assigned to the Air Force by the Secretary of Defense in September 1959. These programs were designated Midas (missile detection alarm system), which involved an infrared early warning satellite for ballistic missile detection, and Samos, a reconnaissance-type satellite system.

Both programs were to be conducted by the Ballistic Missile Division in the Vandenberg/Point Arguello area, utilizing the Atlas as the main booster, with the second-stage Agena.

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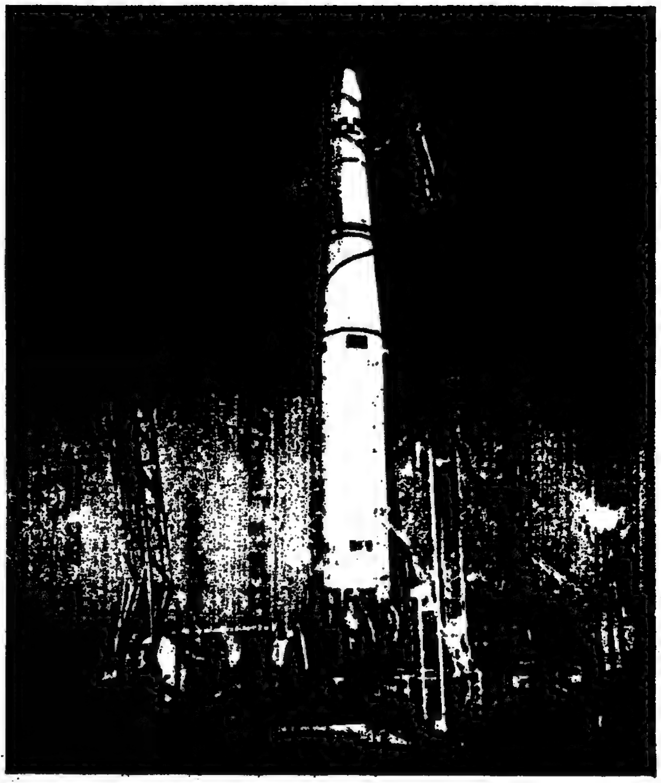
*In February 1960, a "mystery satellite" was discovered in a polar orbit. It was eventually determined to be one of the Discoverers which, evidently pointed in the wrong direction at the time the signal to eject was given, had soared into a continuing orbit. Until rediscovered, the Air Force had presumed the satellite lost on re-entry.

DISCOVERER V at lift-off.



DISCOVERER VIII being prepared for launch.

To launch these vehicles two ARDC organizations were activated at Vandenberg in 1959, the 6594th Launch Squadron, and the 6596th Instrumentation Squadron, with personnel provided by the Division from its Thor and Jupiter training resources.

The Discoverer, Samos and Midas satellite programs were the beginning of an expansion of the Vandenberg missile complex into a national aerospace center.*

Titan and Minuteman ICBMs

In addition to the Thor and Atlas, two of the newer ballistic missile systems were scheduled to make an appearance at the base---the giant two-stage Titan ICBM and the three-stage solid-fueled Minuteman, the nation's third intercontinental missile.

A Titan organization was created at Vandenberg on February 1, 1959, with activation of the 395th Missile Training Squadron under the 1st Missile Division. Five days later, at Cape Canaveral, the first Titan was successfully fired in an encouraging beginning to the test program.[47]

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*Several National Aeronautics and Space Administration (NASA) scientific programs---including Tiros, the weather satellite project---also were scheduled to utilize Vandenberg Air Force Base launch facilities.

Training the 395th

By early spring the military instructor program of the 395th was begun with the assignment of individual squadron members to study at the various contractor facilities and the Air Force Missile Test Center. When technically qualified, these personnel would provide an "all Air Force" instructor capability at Vandenberg at the start of IWST for the operational Titan units, which involved 14 squadrons sited at various locations around the nation.

While this instructor training program was being implemented during the last half of 1959, the Division's attention was centered on developing plans for Titan integrated weapon system training, and on the unusual construction being accomplished---the huge missile silos and underground supporting facilities. Construction of the first Titan silo emplacement, an Operational System Test Facility, was started in July 1958. This R&D site, to be operated by the Air Force Ballistic Missile Division, included a main silo 165 feet deep and 40 feet wide. It contained an intricate maze of steel and cables to elevate the missile to ground level for the launching. The silo was covered by two enormous steel-and-concrete doors, weighing 283 tons each, to provide

Main tunnel of the 395-A Titan complex leading from the underground control center to the silo launching emplacement.

protection against a nuclear blast.*

In addition to this facility, in June 1959 construction was started on the first Titan operational silo training emplacement for use by the 395th Missile Training Squadron in the IWST program.[48] Other Titan test and launch facilities at Vandenberg also were scheduled to make a later appearance.

The Unique Minuteman

While Titan is considered somewhat complementary to the Atlas ICBM (both use liquid fuel), the newer generation Minuteman, because of its solid propellant, promised important advantages in terms of faster reaction, economy, mobility and ease of maintenance, handling and storage. In its mobility features alone the 1st Missile Division found the oncoming Minuteman to be unique. General White, the Air Force Chief of Staff, touched briefly on this aspect during an address given in Washington in November 1959.

"Our studies show," he said, "that it will be entirely feasible to deploy Minuteman missiles on railroad cars--

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*Atlas also was scheduled to go underground at Vandenberg. Construction of an Atlas R&D silo to test feasibility of this "hardened" configuration was begun in 1960.

which would move at random over the nation's vast rail network. Obviously, a mobile missile force such as this will compound an enemy's targetting problems---thus further increasing the ability of our missile force to survive an enemy's surprise attack."[49]

With three ICBM weapon systems at Vandenberg, the 1st Missile Division's operational mission was certain to expand in the decade of the 1960s. While training SAC crews to man the various weapon systems sited around the country, the Division also would have the capability of launching three different types of ICBMs in a war situation. Vandenberg, which was already unique, was destined to become the only base in the free world to possess such a diversified strike capability.

pads, where several dozen intermediate range and intercontinental ballistic missiles and Discoverer satellites were launched to help restore America's prestige in the space race, and to build the free world's first long-range missile power.

For the 1st Missile Division and the Strategic Air Command, the achievements of the recent past were simply a prelude to a more important and exciting future. The Division's key training mission would continue---and thousands of American missilemen would come to Vandenberg to train and launch their missiles. Yet even as the ICBM program expanded, it was clear that Vandenberg's role in space was going far beyond the attainment of an operational and training capability in the ballistic missile field. Vandenberg was becoming America's aerospace center on the Pacific, a vast missile and space complex in which the Discoverer, Midas and Samos programs were but a beginning.

For those officers and men of the 1st Missile Division who looked to the end of the 1960s, the conviction also grew that both the ballistic missile and the satellite were transitional vehicles---that development of true American space craft capable of manned flight outside the atmosphere was a certainty, and that Vandenberg would play its role in that ultimate achievement.

CHRONOLOGY

CHRONOLOGY OF THE 1ST MISSILE DIVISION AND VANDENBERG AIR FORCE BASE

May 1941	Army surveyors arrive on Burton Mesa.
Sep 1941	Ground broken for Camp Cooke construction.
Oct 5 1941	Camp Cooke activated as an armored division training installation.
Oct 3 1941	The German V-2, predecessor of modern ballistic missiles, in its first successful test firing travels 118 miles.
Aug 17 1943	More than 500 British bombers attack Peenemunde, Germany's Cape Canaveral, and development site of the V-2.
Sep 13 1943	1st Air (originally Bombardment) Division activated in England.
Sep 6 1944	The first two operational V-2 missiles are fired against Paris.
Sep 8 1944	Two V-2s strike London, marking the beginning of the German ballistic missile assault on that capital.
Oct 31 1945	1st Air Division inactivated in England.
Mar 15 1946	Beginning this date, and continuing until June 27, 1950, the Army Ordnance Corps conducted a V-2 firing program at White Sands. Some 52 of the V-2s were fired in a combined scientific/military test program.
1946-47	The Air Force initiated a preliminary long-range ballistic missile development program. Contracts negotiated with North American for rocket propulsion; with Convair for study of missile guidance and control, etc.

Aug 7 1950	Camp Cooke reactivated to train armored and infantry troops for the Korean War.
Jan 1951	The Air Force awarded a contract to Convair for study and design of an intercontinental ballistic missile. Conservative development policies are followed.
Nov 1 1952	The United States exploded its first hydrogen bomb device at Eniwetok atoll in a "thermonuclear breakthrough."
Feb 1 1953	Camp Cooke inactivated towards the close of the Korean War.
Summer 1953	An Air Force panel of scientific advisers was asked to make the best prediction they could as to the weight and yield relationships of the nuclear warhead by the end of the decade. They reported it appeared probable that high yield/low weight warheads, capable of fitting into an ICBM, could be achieved by 1959-1960.
Feb 1954	After reviewing the Air Force missile program, and the impact of the thermonuclear breakthrough, the Air Force Strategic Missiles Evaluation Comittee recommends that the United States "redirect, expand and accelerate" the ICBM program.
Aug 1954	A special Air Force research and development organization was created: the Western Development Division of ARDC (now the Air Force Ballistic Missiles Division). This organization was given the responsibility for developing the new ballistic missile weapon system and achieving the initial operational capability.
Sep 5 1955	The ICBM program was assigned the "highest national priority."

Nov 28 1955	AFBMD was directed to proceed with the development of an intermediate range ballistic missile (Thor IRBM). The Army also was directed to proceed with a similar development, the Jupiter.
Sep 1 1956	Secretary of the Air Force Donald Quarles approved the location of the ICBM/IRBM operational training site at Camp Cooke, California.
Jan 25 1957	The first Thor IRBM was launched in a test at Patrick AFB, Florida.
Mar 18 1957	The 1st Air Division was redesignated the 1st Missile Division, and the 392d Base Headquarters and Air Base Squadron was redesignated and reconstituted as the 392d Air Base Group.
Apr 15 1957	The 1st Missile Division and the 392d Air Base Group were activated. Colonel William A. Sheppard named the first commander of the Division.
Jun 7 1957	The Air Force portion of Camp Cooke renamed Cooke Air Force Base.
Jun 11 1957	The first test launching of an Atlas ICBM was conducted at Patrick AFB, Florida.
Jul 1 1957	The 704th Strategic Missile Wing (ICBM-Atlas) was activated at the base.
Jul 16 1957	Headquarters, 1st Missile Division changed its operational location from Inglewood, California to Cooke.
Aug 1 1957	The 1st Missile Division assumed operational control of the 704th Strategic Missile Wing.
Aug 26 1957	The Soviet Union announced launching of its first successful ICBM.
Sep 15 1957	The 392d Missile Training Squadron was activated.

Oct 4 1957	The Soviet Union launched the world's first artificial earth satellite into successful orbit.
Oct 23 1957	Ground was broken for the first increment of 880 Capehart family housing units on base.
Nov 3 1957	The Soviet Union launches its second artificial earth satellite, weighing 1,117 pounds and carrying a living dog.
Nov 23 1957	The Department of Defense authorized peacetime launchings of ballistic missiles from the base.
Nov 29 1957	General Thomas D. White, USAF Chief of Staff, announced plans to transfer the 1st Missile Division, and responsibility for developing the initial operational capability (IOC) of ballistic missiles, from ARDC to SAC. On this same day General Thomas S. Power, Commander-in-Chief of SAC, named Major General David Wade, SAC Chief of Staff, to head the 1st Missile Division.
Jan 1 1958	Headquarters 1st Missile Division, its subordinate commands, and the base were transferred from ARDC to SAC.
Jan 2 1958	Major General David Wade assumed command of the 1st Missile Division.
Jan 15 1958	Activation of the 864th Strategic Missile Squadron (IRBM-Jupiter) at Redstone Arsenal, Alabama, with assigned to SAC under 1st Missile Division.
Feb 1 1958	The 704th Instrumentation Squadron activated at the base.
Feb 24 1958	Detachment #1, 704th Strategic Missile Wing, is organized at Redstone Arsenal, Alabama.
Feb 28 1958	The Secretary of Defense directed the Air Force to assume all research and development responsibilities for all land-based IRBMs and ICBMs.

Apr 1 1958	The 576th Strategic Missile Squadron (ICBM-Atlas) is activated at the base.
May 1 1958	The 4315th Student Squadron designated and organized.
May 8 1958	The first missile, a non-operational Atlas, was delivered to the base.
May 12 1958	The first Air Force family moved into the Capehart family housing development.
Jun 1 1958	The 865th Strategic Missile Squadron (IRBM-Jupiter), activated at Redstone Arsenal.
Jul 25 1958	The 51st Aviation Depot Squadron activated. A contract awarded the same day on the second group of Atlas launchers.
Jul 31 1958	Construction begun on prototype Titan facility, an Operational System Test Facility, at the base.
Aug 5 1958	The first RAF students arrive to begin Thor integrated weapon system training.
Aug 13 1958	The first operational Thor IRBM was delivered to the base.
Aug 20 1958	The first Thor IWST class begins.
Sep 1 1958	The 866th Strategic Missile Squadron (IRBM-Jupiter) was activated at Redstone Arsenal.
Sep 4 1958	USAF directed all Jupiter training be conducted at Redstone Arsenal.
Sep 19 1958	The first Thor class completed IWST.
Oct 4 1958	Cooke is renamed Vandenberg Air Force Base in honor of the late General Hoyt S. Vandenberg.
Dec 8 1958	The first 25-ton/day liquid oxygen (LOX) and nitrogen generator plant becomes operational.

Dec 15 1958	The first Thor missile launched from Vandenberg Air Force Base.
Jan 15 1959	The 644th Strategic Missile Squadron (IRBM-Thor) activated at Vandenberg. The 703rd and 706th Strategic Missile Wings transferred from the 1st Missile Division to the 15th Air Force. The first Atlas complex, 576-A, turned over to SAC after completion of basic construction; installation and checkout of ground support equipment commenced.
Feb 1 1959	The 395th Strategic Missile Squadron (ICBM-Titan) activated at Vandenberg Air Force Base.
Feb 28 1959	Discoverer I, the first polar-orbiting artificial earth satellite, launched from Vandenberg Air Force Base.
Mar 2 1959	The first formal equipment-oriented IWST class began for Thor students.
Mar 26 1959	The United States/Italian intergovernmental agreement signed on deployment of Jupiter missiles and technical personnel to Italy.
Apr 9 1959	A Thor IRBM exploded on its stand during a static firing test at Vandenberg.
Apr 13 1959	Discoverer II launched from Vandenberg Air Force Base into polar orbit. Satellite recovery attempt failed.
Apr 15 1959	The 864th Strategic Missile Squadron (IRBM-Jupiter), redesignated the 864th Technical Training Squadron.
Apr 16 1959	An RAF crew launches their first Thor IRBM down the Pacific Missile Range.
May 25 1959	The 865th Strategic Missile Squadron (IRBM-Jupiter) redesignated the 865th Technical Training Squadron.

Jun 1 1959	Detachment #1, 704th Strategic Missile Wing, discontinued at Redstone Arsenal.
Jun 3 1959	Discoverer III launched successfully from Vandenberg, but failed to achieve polar orbit.
Jun 16 1959	A second RAF Thor launched, but failed to program as planned. The missile was destroyed by missile flight safety officer.
Jun 25 1959	Discoverer IV successfully launched but satellite failed to achieve an orbit.
Jul 1 1959	Detachment #1, Headquarters 1st Missile Division, was designated and organized at Redstone Arsenal, Alabama. The 704th Strategic Missile Wing was inactivated at Vandenberg.
Jul 23 1959	Construction begun on semi-hardened (25 psi over-pressure) launcher in Atlas complex 576-C.
Aug 3 1959	A third RAF Thor launch from Vandenberg Air Force Base was successful.
Aug 7 1959	Basic construction completed on Atlas complex 576-B; installation and checkout phase began.
Aug 13 1959	Discoverer V launched from Vandenberg, attained orbit. The satellite was not recovered.
Aug 14 1959	Fourth RAF Thor successfully launched from Vandenberg.
Aug 19 1959	Discoverer VI successfully launched into a polar orbit; the satellite was not recovered.
Aug 22 1959	First static firing of an Atlas accomplished at complex 576-A at Vandenberg.
Sep 1 1959	Complex 576-A, the first Atlas IOC launchers, were formally accepted by the 1st Missile Division.

Sep 9 1959	The first Atlas ICBM was successfully launched from Vandenberg Air Force Base by a SAC crew.
Sep 17 1959	The fifth RAF Thor launch from Vandenberg.
Sep 22 1959	Agreement for coordinated peacetime operation of the Pacific Missile Range was signed by Vice Chief of Staff, General Curtis LeMay, and Admiral Arleigh Burke, Chief of Naval Operations. The agreement expanded the role of the Navy in the area of missile safety and satellites launched from the Vandenberg/Point Arguello area.
Sep 23 1959	The Department of Defense announced that the Air Force would be given major responsibility for development, production and launching of military space boosters. Several immediate projects, Midas and Samos, early warning and reconnaissance satellite systems, were transferred to the Air Force. Vandenberg/Point Arguello to be the scene of a number of these launchings.
Oct 6 1959	The RAF launched a sixth Thor IRBM, which also constituted the first combat training launch by missilemen returning to Vandenberg from England.
Oct 21 1959	The seventh RAF Thor launched.
Nov 1 1959	The 644th Strategic Missile Squadron (IRBM-Thor) was inactivated at Vandenberg; the 865th Technical Training Squadron inactivated at Redstone Arsenal.
Nov 4 1959	Construction begun on an Atlas silo launcher. General Wade announced the Atlas at Vandenberg had been integrated into the SAC emergency war plan (EWP).
Nov 7 1959	Discoverer VII successfully launched and orbited; the satellite was not recovered.

Nov 12 1959	The eight RAF Thor was launched from Vandenberg.
Nov 20 1959	Discoverer VIII successfully launched and orbited; the satellite was not recovered.
Dec 1 1959	A ninth RAF Thor was launched, the second combat training launch. It also constituted the first night launching from Vandenberg.
Dec 14 1959	A tenth RAF Thor was launched at night. After 149 seconds of flight the missile destroyed itself over the ocean.
Jan 1 1960	The 866th Strategic Missile Squadron (IRBM-Jupiter) redesignated the 866th Technical Training Squadron.
Jan 21 1960	An eleventh RAF Thor was launched from Vandenberg, marking the end of the formal IWST program.
Jan 26 1960	The second Atlas was successfully launched from Vandenberg.
Feb 4 1960	Discoverer IX successfully launched and orbited. The satellite was not recovered.
Feb 19 1960	Discoverer X became unstable shortly after liftoff and was destroyed after approximately 56 seconds of flight.
Mar 2 1960	A twelfth RAF launch crew fires another Thor, in the third combat training launch exercise.

Appendix I

IMPACT OF VANDENBERG AIR FORCE BASE ON THE SURROUNDING COMMUNITIES

Impact of Vandenberg Air Force Base on the Surrounding Communities*

Since 1957 the cities and towns in the vicinity of Vandenberg Air Force Base in northern Santa Barbara County, California, have experienced tremendous economic growth, traceable to the rapid buildup of the aerospace center. The most dramatic example of this was seen in the community of Lompoc, 10 miles south of the base, where a "population explosion" doubled its residents between 1957 and 1960. From a figure of 6,500 in 1957 the population of the town jumped to more than 14,000 persons by early 1960.

Santa Maria, 20 miles to the north, increased 43 percent during the same period. By 1960 the population stood at 20,050 persons, a rise from 14,000 in 1957.

In both cities a housing boom developed. From only 16 building permits valued at $441,000 issued in Santa Maria in 1956, construction rose to $1,041,000 in 1957 (76 permits), to $12,339,096 in 1958 (1,203 permits), to $18,070,840 in 1959 (415 consolidated permits).

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*See Survey on the "Economic Impact on Local Economy," prepared by D/Comptroller, 1st Missile Division, December 1959.

The impact on all municipal facilities was soon felt. In the case of the local schools, some 7,800 Vandenberg-connected children were added to the population in the three-year period. Fifty-four percent of these children attended classes in the Lompoc school district, 31 percent in Santa Maria. The other 25 percent were spread out in schools in the smaller communities of Orcutt, Guadalupe, Arroyo Grande and elsewhere. To help ease this situation, federal funds in the amount of $3,000,000 were provided for school construction in Lompoc, and $400,000 provided Santa Maria. Other federal funds for the schools also were granted.

Some additional brief facets of the Vandenberg-created boom:

1. Santa Maria taxable sales rose to almost $41 million in 1959, an increase of almost 60 percent over 1958 and more than double 1957. 1958-59 sales were equal to sales during the previous four years combined.

2. Over eight million miles were driven monthly to and from work; over $750,000 were spent monthly on transportation. 2,748 employees at the base rode in car pools.

3. Over $250,000 per month was spent on utilities. For the base alone, the electricity bill was $46,000 per

month and the gas bill, $19,000.

4. Almost $1 million per month was spent on food. The Vandenberg commissary alone bought over $40,000 worth of milk and bread.

5. Over 2½ times as many dwellings were authorized in Lompoc during 1958-59 as during the previous 12 years (2,510 units versus 938).

6. As many dwelling units were authorized for construction in Santa Maria in 1958-59 as during the 12 prior years combined (1,924 units versus 1,918).

7. Thirty-seven percent of the approximately 12,000 personnel who worked at Vandenberg lived on base. Fifty-one percent lived in Lompoc and Santa Maria.

8. These Vandenberg-connected people had 25,830 dependents, 22,659 of them physically present in the area.

Appendix II

MISSILE AND SPACE VEHICLES AT VANDENBERG

A TECHNICAL DESCRIPTION

THOR INTERMEDIATE RANGE BALLISTIC MISSILE

RANGE - Over 1,500 nautical miles.

FRAME - Single stage.

Height: 65 feet.
Weight: 110,000 pounds.
Diameter: 8 feet.

GUIDANCE - Inertial.

POWERPLANT - Rocketdyne liquid-fueled.

Propellants: Liquid Oxygen (LO^2) and a liquid hydrocarbon called "RP-1".
Thrust: Over 150,000 pounds.

WARHEAD: - Contains nuclear materials.

The THOR is a single-stage ballistic missile capable of being transported by air on a transporter-erector trailer which also serves as the missile erecting arm.

The THOR has been used as the main propulsion system for several space experiments. It is the primary vehicle in the DISCOVERER program.

ATLAS INTERCONTINENTAL BALLISTIC MISSILE

RANGE - Over 6,000 nautical miles.

FRAME - $1\frac{1}{2}$ stages. First booster consists only of engines, which operate from main fuel tanks. Main stage consists of sustainer engine, fuel tanks, and airframe.

Height: 81 feet.
Weight: 260,000 pounds.
Diameter: 10 feet.

GUIDANCE - Radar. Doppler Command on first operational models. Later models to be all inertial, as with the THOR.

POWERPLANTS - Rocketdyne liquid-fueled.

Propellants: Liquid Oxygen (LO^2) and RP-1.
Thrust: 300,000 pounds for first stage. 60,000 pounds for sustainer.

WARHEAD: - Contains nuclear materials.

Designed to impact a target more than 5,500 nautical miles distant with an error of less than two-tenths of one percent, the ATLAS is guided over approximately the first 10% of its flight. The two boosters drop away after about two minutes blast and the missile continues on the power supplied by its lower-thrust sustainer. Two verniers located on the lower portion of the body supply roll control and thrust adjustment throughout second-stage flight.

TITAN INTERCONTINENTAL BALLISTIC MISSILE

RANGE - Well over 6,000 nautical miles.

FRAME - A true two-stage missile, in which each stage comprises a closed system with individual fuel tanks, engines, guidance devices, etc.

Height: 91 feet, overall.
First Stage Height: 54 feet.
Second Stage Height: 37 feet, including re-entry vehicle.
Weight: 220,000 pounds.
Diameter: 8 feet.

GUIDANCE: - Initially, radio inertial. Later models to be all-inertial, as THOR.

POWERPLANTS - Aerojet-General liquid-fueled.

Propellants: Liquid Oxygen (LO^2) and a liquid hydrocarbon called "JP-6".

Thrust: 300,000 pounds for first stage. 80,000 pounds for sustainer.

WARHEAD: - Contains nuclear materials.

A complement, rather than a duplicate of ATLAS, TITAN employs a different flight technique than its companion ICBM. A true two-stage missile, it is launched initially by a 300,000 pound-thrust booster. At burnout, the first stage separates from the remainder of the missile and a second liquid engine pushes the nuclear payload to an extremely high speed and altitude. The second stage also drops after burnout and the re-entry vehicle travels in a ballistic flight path to its target.

MINUTEMAN INTERCONTINENTAL BALLISTIC MISSILE

Height: 55 feet.

Weight: 80,000 pounds, smaller and lighter than Atlas or Titan.

Design range: 6,500 nautical miles.

Three-stages, using solid propellant, with all-inertial guidance. A four-nozzle system will permit control of pitch, yaw and roll. Third-stage power will cut off before burnout if desired.

THE DISCOVERER TEST VEHICLE CONFIGURATION

Height: 78.2 feet.

FIRST STAGE - A modified THOR IRBM

Height: 66.7 feet (with adapter).
Weight: Over 100,000 pounds.
Thrust: Approximately 150,000 pounds.

SECOND STAGE - Special orbital vehicle.

Length: 18.8 feet.
Weight: Approximately 7,000 pounds. Orbital weight, after fuel exhaustion: approximately 1,700 pounds.

Diameter: 5 feet.

PAYLOAD

The Discoverer payload consists of 40 pounds of telemetry equipment. It is advanced in design, circuitry techniques and miniaturization. It operates on 15 channels - 10 continuous and 5 commuted - which relay about 100 pieces of vital information on the performance of the vehicle and its systems.

An additional feature of this vehicle is the Infrared Horizon Scanner, which sends continuous signals to the guidance system, orienting the satellite in an exact horizontal position.

BIBLIOGRAPHY AND NOTES

BIBLIOGRAPHY

Books

Churchill, Winston. Closing the Ring. Boston, 1951.

Craven, W.F. and J.L. Cate, eds. Europe - Torch to Pointblank, August 1942 to December 1943, THE ARMY AIR FORCES IN WORLD WAR II. Chicago, 1949.

Gantz, Lt. Col. F., ed. The United States Air Force Report on the Ballistic Missile. New York, 1958.

Dornberger, Walter. V-2. New York, 1954.

Ley, Willy. Rockets, Missiles and Space Travel. New York 1959.

Storke, Yda Adda. A Memorial and Biographical History of the Counties of Santa Barbara, San Luis Obispo and Ventura, California. Chicago, 1891.

Unit Histories

USAF Historical Division. "Brief History of 1st Bombardment Division, 1943-1957." Maxwell Air Force Base.

1st Missile Division Historical Office. "History of the 1st Missile Division, April-June 1957."

________________. "History....July-December 1957."

________________. "History....January-December 1958."

________________. "History....January-June 1959."

________________. "History....July-December 1959."

________________. "History....of the 704th Strategic Missile Wing, July-December 1957."

Articles

Angell, Joseph W. "Guided Missiles Could Have Won," Atlantic Monthly (January 1952).

Baar, James and William E. Howard. "AF Training 14,000 ICBM Crewmen," Missiles and Rockets, January 4, 1960.

Baker, Norman L. "Vandenberg....Space Base," Missiles and Rockets, August 25, 1958.

Ford, Carey and James Perkins. "Boss of the Missilemen," Saturday Evening Post, August 23, 1958.

Miller, Ed Mack. "Springboard to the Stars," Air Force Magazine, October 1958.

Neeson, John V. "Vandenberg," Space Age, November 1959.

Reed, William S. "Vandenberg Trains USAF Missile Crews," Aviation Week, October 26, 1959.

Ritchie, Donald J. "Soviet Rockets Exploit German Technology," Missile and Rockets, December 7, 1959.

"Men, Machines Changing Face of Earth at Cooke," Santa Barbara News-Press, September 11, 1958.

"Vandenberg Missile Base is a Far Cry from the Dreams of the Past," Santa Barbara News-Press, October 5, 1958.

"Missile Man," Skyline, vol. 16, No. 2 (Summer 1958).

Miscellaneous

Historical Division, SAC. A Missile Chronology of the Strategic Air Command, 6 October 1955 - 15 January 1958.

General Thomas S. White, USAF. Address Before NATO Parliamentarian Conference, Washington, D. C., November 16, 1959.

Major General Bernard Schriever. "Guided Missile Research and Development in the U.S. Air Force," An Address at the annual meeting of the Institute of Aeronautical Sciences, New York, January 29, 1957.

"A Briefing on Cooke Air Force Base," undated.

NOTES

1. Yda Adda Storke. A Memorial and Biographical History of the Counties of Santa Barbara, San Luis Obispo and Ventura, California (Chicago, 1891), p. 106.

2. "Vandenberg Missile Base is a Far Cry from the Dreams of Past," Santa Barbara News-Press, October 5, 1958.

3. USAF Historical Division. "Brief History of 1st Bombardment Division, 1943-1957," pp. 1-2.

4. W.F. Craven and J.L. Cate, eds. Europe - Torch to Pointblank, August 1942 to December 1943 in THE ARMY AIR FORCES IN WORLD WAR II (Chicago, 1949), pp. 699-704.

5. Winston Churchill. Closing the Ring (Boston, 1951), pp. 232-33.

6. Willy Ley. Rockets, Missiles and Space Travel (New York, 1959), p. 237. See also: Walter Dornberger's V-2 (New York, 1954) and Joseph Angell. "Guided Missiles Could Have Won," Atlantic Monthly (January 1952), pp. 57-63.

7. Ley, op. cit., p. 239.

8. Maj. Gen. Bernard Schriever. "Guided Missile Research and Development in the U.S. Air Force," An Address at the annual meeting of the Institute of the Aeronautical Sciences, New York, January 29, 1957.

9. Ibid.

10. Lt. Col. Kenneth F. Gantz, ed. The United States Air Force Report on the Ballistic Missile (New York, 1958), pp. 27-30.

11. Historical Division. "History of the 1st Missile Division, April-June 1957." See Document No. 2.

12. Ibid.

13. Historical Division. "History of the 704th Strategic Missile Wing, July-December 1957," See Document No. 69.

14. Headquarters ARDC, General Order No. 17, March 27, 1957.

15. Historical Division. "History of the 1st Missile Division, April-June 1957," p. 16.

16. Ltr, Col. William Sheppard to Lt. Col. Nicolaus Gaynos, May 2, 1957.

17. Cited in "A Briefing on Cooke Air Force Base," undated pamphlet.

18. Historical Division. "History of the 704th Strategic Missile Wing, July-December 1957." See Document No. 5.

19. Historical Division. "History of the 1st Missile Division, April-June 1957," p. 68.

20. Emile Genest, Technical Liaison Officer, U.S. Corps of Engineers, in the _SAC Missileer_, November 19, 1959, p. 1.

21. The Soviet announcement may be found in _The World Almanac_ for 1958, p. 117.

22. Historical Division, Hq SAC. _A Missile Chronology of the Strategic Air Command_, 6 October 1955 - 15 January 1958.

23. Ltr, General Thomas Power to Major General David Wade, subject: "Command of the 1st Missile Division," December 17, 1957.

24. Historical Division. "History of the 1st Missile Division, January-December 1958," p. 118.

25. _Ibid_., p. 19.

26. _Ibid_., p. 91.

27. _Ibid_., p. 98.

28. _Ibid_., pp. 107-08.

29. _Ibid_., pp. 113-14.

30. Historical Division. "History of the 1st Missile Division, January-June 1959," p. 18.

31. *Ibid.*, p. 27.

32. *Ibid.*, pp. 29-30.

33. *Santa Maria Times*, December 2, 1959, p. 1.

34. *New York Times*, December 10, 1959.

35. *SAC Missileer*, January 22, 1960.

36. *Los Angeles Times*, June 7, 1959.

37. *New York Times*, July 29, 1959.

38. Historical Division. "History of the 1st Missile Division, July-December 1959." See Chapter IV.

39. *Santa Maria Times*, September 9, 1959.

40. *Los Angeles Times*, September 10, 1959.

41. See Colonel John J. Easton's remarks in the *Lompoc Record*, September 10, 1959. Colonel Easton was commander of the 576th.

42. *Santa Maria Times*, November 3, 1959.

43. See Johnson's testimony, February 17, 1959, in Hearings Before Committee on Science and Astronautics on "Missile Development and Space Sciences (86th Congress, 1st Sess.), House No. 11, p. 316.

44. Historical Division. "History of the 1st Missile Division, January-June 1959," p. 166.

45. *Santa Barbara News-Press*, November 3, 1959.

46. Historical Division. "History of the 1st Missile Division, January-June 1959," p. 106.

47. *Ibid.*, p. 109.

48. General Thomas S. White, USAF Chief of Staff. Address before NATO Parliamentarian Conference, Washington, D.C., November 16, 1959.

President John F. Kennedy watches
ATLAS launch at Vandenberg AFB, 23 March 1962